2016 Infrastructure Report

Department of Public Works

Town of Framingham

May 2016

2016 Infrastructure Report

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Executive Summary

The Town of Framingham manages and maintains several infrastructure systems serving our residents, businesses and institutions. This report provides a summary of the state of this infrastructure, and includes the roadway and transportation system, stormwater system, water distribution system and wastewater collection system.

While almost half the Town's roadways were built by World War II, about twenty five percent (25%) of the Town's current stormwater, water and wastewater infrastructure was in place by then and is therefore over 70 years old. In most cases, this is at or near the end of the normal life expectancy for the pipes, manholes and valves that comprise the stormwater, water and wastewater systems.

In the 25-year period after World War II, the Town's population almost tripled, from 23,000 to 65,000 residents. During this time another fifty percent (50%) of the stormwater, water and wastewater systems were installed. Unfortunately, there were deficiencies in many of these systems that were not anticipated.

Today the Town is in a period where many of our roadways are aging and the pipes installed over 70 years ago are at or near the end of their life expectancy and many other pipes installed 45 to 70 years ago are deteriorating at a faster rate than expected due to poor construction practices. In addition, many portions of the systems were installed in a haphazard fashion that led to downstream deterioration, the most problematic being the wastewater system.

Starting in 2006, the Town embarked on an accelerated Capital Improvement Program to remedy this situation. Since that time, the Department has replaced or improved several of the most challenging of the system's problem areas. Table ES-1 below summarizes the improvements made to our systems in the past 10 years. While there is still much to be done, several of the most difficult repairs and replacements have been completed. The near-term focus of the capital program is the upgrade of the two-thirds of the pumping stations that require attention, and several major corridors of water, wastewater and roadway that need to be replaced. Once these major improvement projects are completed, ongoing maintenance and rehabilitation work will still be required to maintain the Town's system in good condition.

Table ES-1. Infrastructure Improvements since 2006

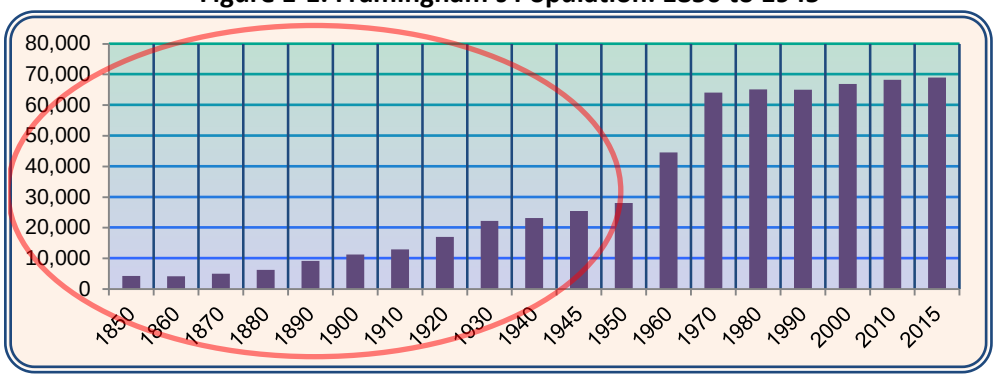
System	Current System Inventory	Improvements 2006 - 2015
Roadway	250 Miles of Roadway 170 Miles of Sidewalk	Replaced 40 miles of roadway and associated sidewalks Resurfaced another 45 miles of roadway
Stormwater	200 Miles of Pipe 10,000 Catch Basins/Manholes 600 Outfalls	Replaced 5 miles of pipe and associated catch basins / manholes
Water	276 Miles of Pipe 2,360 Hydrants 6 Water Tanks 4 Pumping Stations, 3 Booster Stations	Replaced 25 miles of pipe (and associated hydrants) Installed/Replaced/Rehabilitated 3 tanks Installed/Replaced/Rehabilitated 3 stations
Wastewater	228 Miles of Gravity Main 6,900 Manholes 13 Miles of Force Main (originally 19) 42 Pumping Stations (originally 48)	Replaced or lined 27 miles of pipe and associated manholes Eliminated 6 miles of force mains Eliminated 6 stations Replaced 9 stations

1 Background

1.1 Industrialization Period: 1880 – 1945

From the time the Town was incorporated in 1700 to the end of World War II in 1945, the population increased at a steady, manageable pace to 25,000 in 1945 (Figure 1-1). Neighborhoods that were developed during this time included Union Avenue, the Butterworth Park area (east of south Concord Street) and Hollis Street.

Figure 1-1. Framingham's Population: 1850 to 1945



Note: 1945 information obtained from *The Decennial Census, 1945*, published by the Massachusetts Secretary of the Commonwealth. The remaining data are from the US Census.

During this time, the infrastructure also grew at a steady pace to meet the demands of the Town (Figure 1-2). For each of the periods described in the next sections, four maps show the progress of each major component of the Town's infrastructure. The infrastructure is shown on a cumulative basis, depicting where and how the Town's growth has had an impact on the infrastructure.

Figure 1-2. Framingham Prior to 1946: Roadways, Stormwater, Water, and Sewer (red lines)

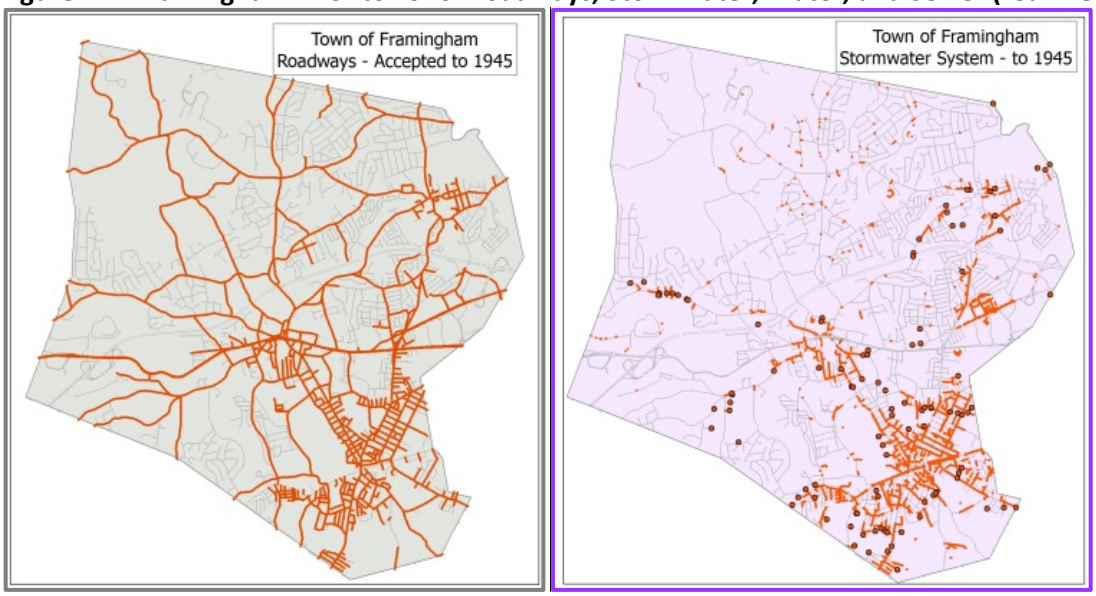
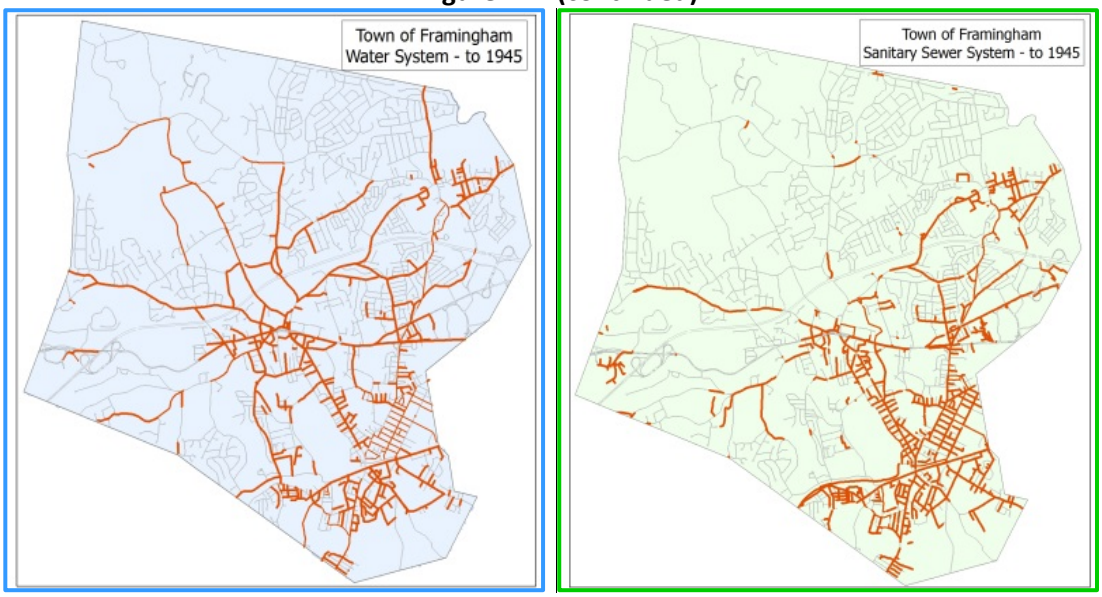


Figure 1-2. (continued)



Roadway: The larger roadways, also known as arterial and collector roads, were well established by 1945, as can be seen in Figure 1-2. Over 128 miles of roadway were built during this time. They include Beaver Street, Central Street, Concord Street, Edgell Road, Grove Street, Hollis Street, Union Avenue, Waverly Street and Worcester Road (later known as Route 9). Residential neighborhoods were close to the business centers, especially along Main Street, Union Avenue, south Concord Street/Bishop Street and Hollis Street. Of note during this period:

- The pace of growth was manageable and allowed for streets to be properly designed, built and accepted by the Town.
- The railway system in Framingham, having been constructed during the late 1800s, was completely developed long before the roadways. Rail lines bisect the Town completely from north to south, and again from east to west. Framingham was a hub of railroad activity, and to this day the rail system is still a significant presence in the Town.
- Sidewalks were constructed primarily in downtown areas.

Stormwater: Close to one-quarter of the Town's stormwater system was built during this time. The sole purpose of the system was to drain stormwater away from the roadways during storms. If it was referred to at all, it was called a drainage system. It was not until later that other purposes such as water quality were included in the design of such systems. Of note during this period:

- Before 1910, most of the stormwater pipes were made of vitrified clay, and to a lesser extent iron or stone, and installed within the roadway. These pipes stand up to the corrosive nature of New England soils. However, vitrified clay is brittle and can easily break if not installed deep enough to escape the freeze-thaw cycle of New England's weather. In addition, if any subsurface construction occurs in the vicinity of these fragile pipes, vibrations in the soil can cause breakage and the need for replacement.
- Starting around 1910, construction began to use reinforced concrete pipe in preference over other types of material. These pipes consist of concrete coating with a tight spiral of iron reinforcement, adding great strength to the concrete. While concrete pipes are heavier than vitrified clay, they also stand up to the corrosive nature of New England soils and are much stronger. They can sustain impacts from heavier vehicles and vibrations from nearby construction.

- Pipes were installed to meet the needs of only the roadway. When later improvements created more impervious surfaces such as sidewalks, wider roads and private development, the pipes were no longer able to carry all the stormwater away from the roadway.

Water: The first water mains were installed in the 1880s and until the 1970s were mostly comprised of cast iron. About 78 miles, or one-third of the Town's water system, was installed during this time (Figure 1-2). Of note during this period:

- The water mains were originally fed from Town wells near Farm Pond and from the Sudbury Reservoir via the Sudbury Aqueduct. Starting in 1940, a wellfield at Birch Road supplied all the Town's needs of up to 2.5 million gallons per day. None of these water sources is in use today, although the Massachusetts Water Resource Authority (MWRA) maintains the Sudbury Aqueduct as a backup system. The Town is pursuing reactivation of the Birch Road Wellfield.
- Cast iron pipe was commonly used from the 1880s to the 1970s. It was cast in molds with thicker ends at the bottom as the heavier metal settled in the molds. Internal corrosion issues led to the practice of cement lining of pipes beginning in 1924.

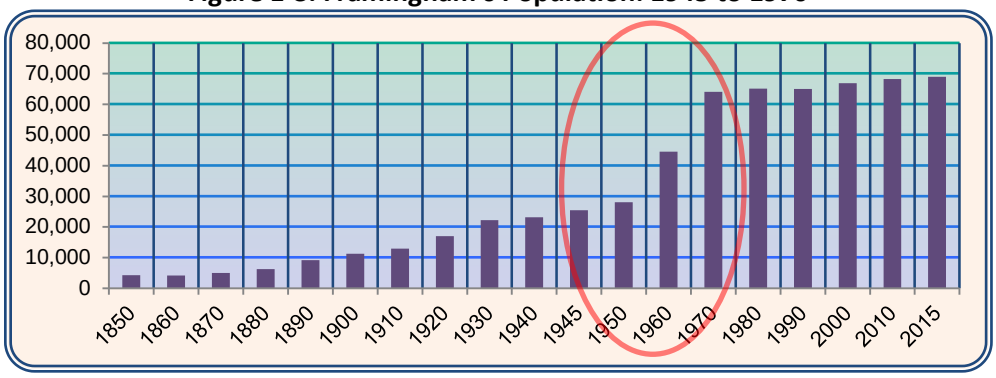
Wastewater: The first wastewater sewer lines were built in 1890s, and until about 1945 consisted mostly of vitrified clay pipe except for a few locations where cast iron pipe was needed for its greater strength. About 57 miles, or one-quarter of the Town's wastewater system, was installed during this time. Of note during this period:

- All sewage was directed to a major discharge line consisting of a 30-inch brick pipe built in 1913 under the eastern end of Waverly Street.
- The sewage was then discharged to a "sewer bed" at a location now occupied by the Natick Mall. A sewer bed is an area where sewage is spread across an open field and allowed to decompose without any treatment.

1.2 Post War Boom: 1945 - 1970

Shortly after World War II, manufacturing, industrial and commercial enterprise increased throughout the Town. The population almost tripled in the 25 years between 1945 and 1970 (Figure 1-3).

Figure 1-3. Framingham's Population: 1945 to 1970

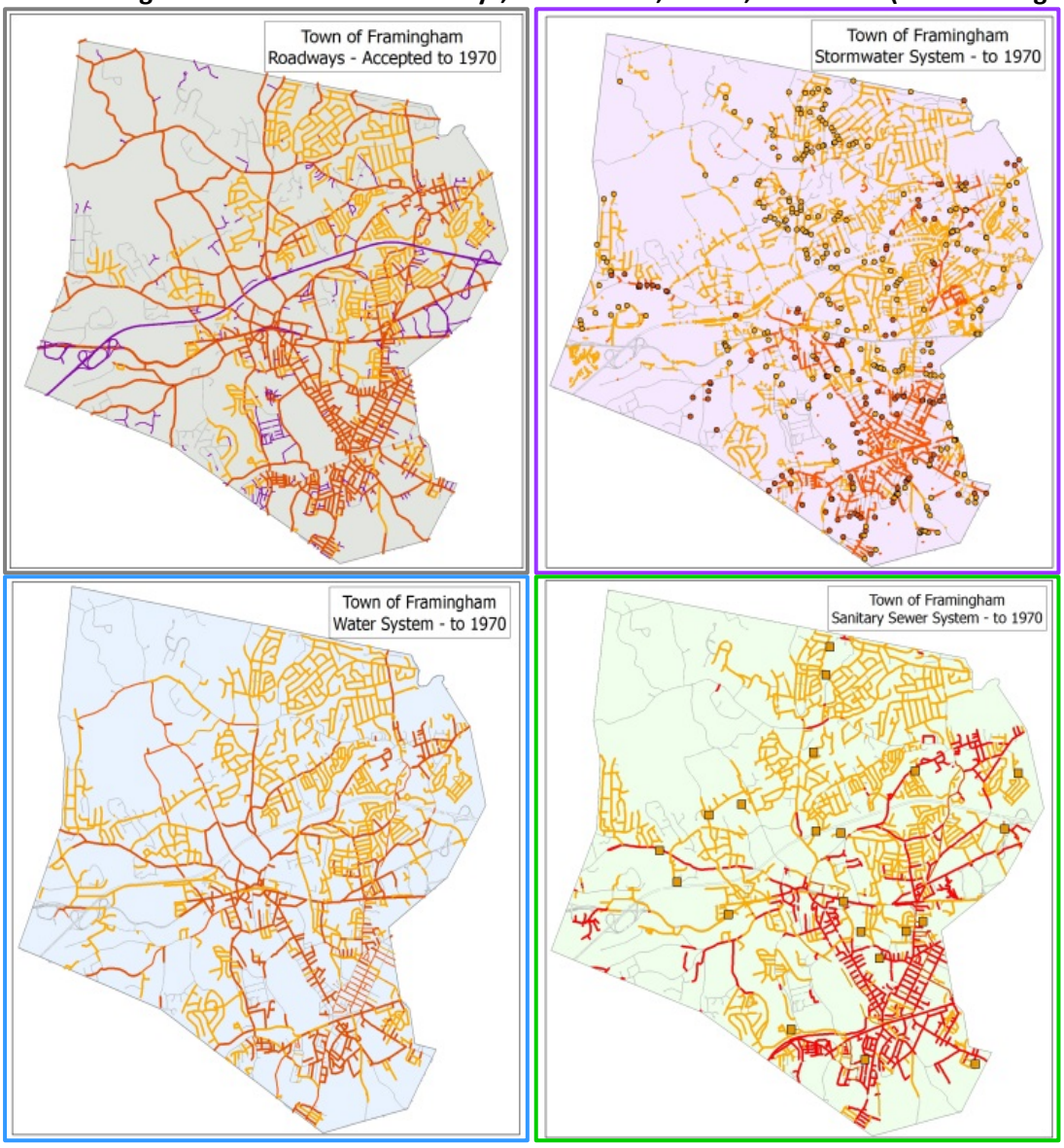


It was a challenge to construct homes, roads, water, sewer and drainage to keep up with the pace of the population growth. Almost all the infrastructure during this time was installed by private developers. Each developer addressed the infrastructure needs of their individual development without assessing the impact on downstream systems. As a result, infrastructure was constructed in a haphazard fashion, with little overall planning or oversight. The most problematic system is the wastewater system, as it poses serious health concerns

for the population that are not immediately visible but are costly to repair. Figure 1-4 shows the infrastructure added during this period.

One of the processes that fell through the cracks during this period of rapid development involved land use. Very few easements were properly obtained for water, sewer and stormwater systems installed off the public way on private properties. Before 1946, easements were fully documented and all legal instruments were developed and recorded. During the post-war boom, most "easements" were nothing more than a map showing an easement on property, but did not include legal instruments such as a grant of easement. This has led to major challenges in maintaining and upgrading the Town's infrastructure. It makes today's maintenance, repair and replacement of these systems more cumbersome and costly as the Town must double back and obtain these easements before work can be done on private properties. There are hundreds of such incomplete easements throughout the Town.

Figure 1-4. Framingham 1945 to 1970: Roadways, Stormwater, Water, and Sewer (added orange lines)



Roadway: Developers built over 100 miles of roadway to support new subdivisions during the population boom. Of note during this period:

- The Massachusetts Turnpike was built in the 1950s and the portion west of route 128 was opened in 1957. With two interchanges within the Town boundary, this new roadway further fueled Framingham's population growth, as well as commercial and industrial growth along Route 9.
- Most of the new roadways were built by developers to support new subdivisions. While some standards were in place, roadways and drainage were not always built to the standards or using best engineering practices. For example, some streets were built without providing proper drainage to wetland areas, thereby leading to flooding of the properties surrounding the wetland during major rain events.
- While many streets were built during this time, not all were accepted by the Town until several years later. This can be seen by comparing the water and sewer lines to the accepted streets in Figure 1-4. For example, the Angelica Drive area roads were not accepted until 1978, although the water and sewer lines were installed a decade earlier. Because there are still about 20 miles of roadway that have not been accepted by the Town, significant efforts will be required to determine the disposition of the roadways.

Stormwater: After World War II, additions to the stormwater system not only drained the new roadways, but often also drained wetlands around new housing developments. The system continued to act solely as a drainage system without consideration of water quality. Of note during this period:

- While reinforced concrete continued to be the material of choice, corrugated metal pipe was also sometimes used, especially for culverts. The use of vitrified clay was largely discontinued.
- Over 50% of the stormwater system was built during this time. While most of the system was installed in the new roadways, many pipes were installed in cross country easements between properties, to mimic the existing drainage pathways.
- As there were few if any regulations governing discharge to wetlands, development sometimes resulted in flooding issues that did not become apparent until many years after the development was completed.

Water: After World War II the water supply system had to expand significantly to meet the growing population needs. Figure 1-4 compares the water mains installed starting in 1946 (in orange) with those installed before 1946 (in red). About 50%, or 125 miles of water mains were installed during this period. Of note during this time:

- In the 1950s, the Town started to purchase water from the Metropolitan District Commission, predecessor of the Massachusetts Water Resource Authority (MWRA), from pumping stations on Pleasant Street, Edgell Road, Elm Street, and Grove Street to supply the Town with drinking water.
- The Birch Road wells operated from 1940 to the mid-1980s, when they were deactivated in favor of purchasing the entirety of the Town's public water supply from the MWRA.
- Most pipes continued to be constructed using cast iron.

Wastewater: After World War II the sanitary sewer system also had to expand significantly to meet the growing population needs. Figure 1-4 compares the sewer lines installed starting in 1946 (in orange) with those installed before 1946 (in red). Over 50%, or 135 miles of sanitary sewer lines were installed during this period. As noted above, each developer addressed the infrastructure needs of their individual development without any apparent obligation of a holistic downstream assessment. This was especially problematic for the wastewater system, and applies both to pumping stations and piping. For example, the Water Street sewer installed in 1958 began experiencing sewer overflows only a few years later as the surrounding farmlands underwent accelerated development. By 1969, the Town's consultant Metcalf and Eddy identified this sewer line as significantly undersized. Of note during this time:

- It was not until after 1945 that the proliferation of sewer pumping stations started. Developers installed pumping stations in the small developments and subdivisions as it was easier and cheaper to build a pumping station than to reconstruct the piping system to allow the use of gravity sewers to convey the wastewater, especially considering obstacles such as railroads, MWRA water transmission lines, and numerous water bodies. Over 20 pumping stations were built to support the 135 miles of new pipe.

- As the system expanded with the new development, there was little concern placed on the downstream sewers. Many of the existing pipes were under-sized for the new flows leading to severe sewer overflows, especially in the northeast section of Town.
- The sewer discharge was shifted from Arthur Street to the Natick sewer beds in the post WWII era, and then back to Arthur Street. This led to several long, large capacity force mains in Framingham and Natick, which are currently in the process of being decommissioned.
- In addition, the "miracle" material of asbestos was introduced in the 1920s and began being used in sanitary sewer pipes. Nearly one-third (31%) of the Town's sanitary sewer pipes were constructed using asbestos cement. Almost all this pipe was installed between 1945 and 1970. Although asbestos is considered a hazardous building material, it is safe in use as a sanitary sewer pipe while the pipe is in good condition. However, sewer pipes made of asbestos cement deteriorate relatively quickly in certain subsurface environments. When the pipe needs to be replaced the removal process involves the same costly safety requirements as used for removing asbestos building materials.

1.3 Population Stagnation, No Infrastructure Investment: 1971 – 2003

After 1970, population growth slowed as manufacturing dropped off (Figure 1-5) and the Town began to reach capacity under its zoning plan. In the 30-year period from 1971 to 2003, the population rose only about four percent (4%), compared with 275% during the 25-year post-World War II boom. This pace is mirrored in the limited infrastructure installed during this time, shown in Figure 1-6. After 2003 the Town began supporting the infrastructure from a financial and structural aspect; this will be discussed further in the Section 2.4.

Figure 1-5. Framingham Population Stagnation: 1970 to 2000

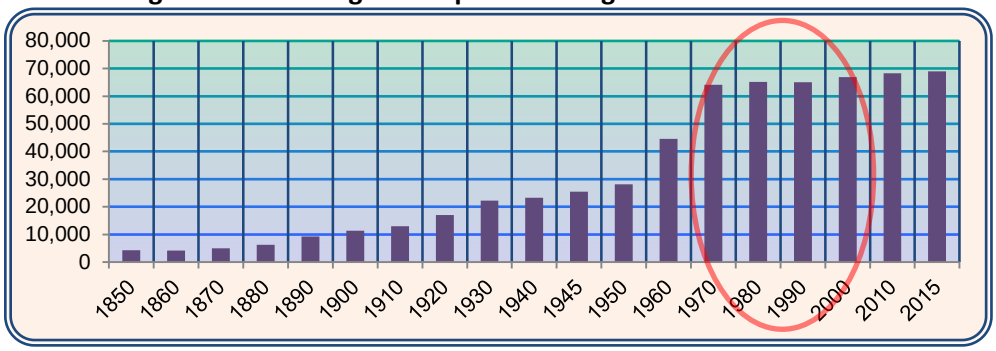
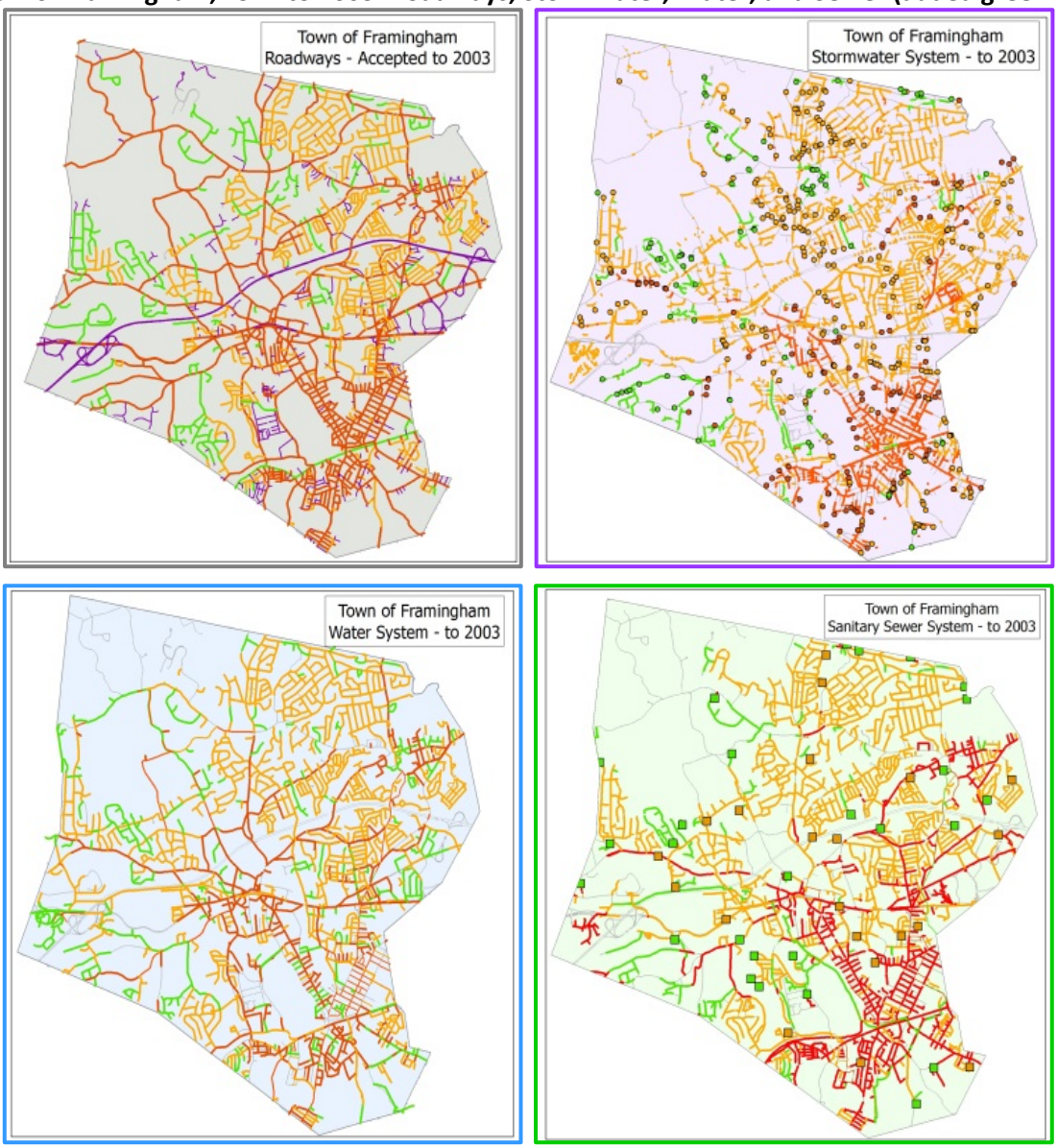


Figure 1-6. Framingham, 1971 to 2003: Roadways, Stormwater, Water, and Sewer (added green lines)



Roadway: The roadway system was essentially completed by 1970, with approximately 10% more added from 1971 to 2003. Figure 1-6 shows the Town's roadway system as of 2003. Of note during this period:

- Prior to 1989, the state's Chapter 90 roadway maintenance funding rules allowed only for funding of improvements to roads leading from one town to another, categorized as "county roads." Examples of county roads include Edgell Road, Elm Street, Hollis Street and Waverly Street. If the Town needed to repave a local road, it would have to be financed through capital appropriations under the Town's General Fund. Thus, road resurfacing was funded through both Chapter 90 funding and Town funding for county roads but only through Town funding for Town local roads.
- In 1989, the state removed the county road restriction and allowed all roadways to be resurfaced using Chapter 90 funding. The Town stopped any self-funding for roadway maintenance and depended only on the Chapter 90 funds for both county and local roads. Since the Chapter 90 funds did not increase to meet this need, less money was available for roadway maintenance and roadways began deteriorating faster than they were resurfaced. Currently, the Chapter 90 program annually provides approximately

$1,500,000 to $2,000,000 to the Town. At that rate, there would only be enough funds to repave roads every 50 years, compared with the actual need to replace roads every 10 to 20 years.

Stormwater: As in the post-war period, up to 2003 the stormwater system was constructed along the roadway system to some extent but was also constructed to drain areas of development, and therefore included several cross-country drainage systems. Figure 1-6 compares the stormwater system installed from 1971 to 2003 (green) with earlier installations (red and orange). There were no significant technological changes during this period, and reinforced concrete continued to be the material of choice for stormwater pipes. However, with the increase in impervious surfaces due to paving of driveways, parking lots and sidewalks, existing stormwater systems became overburdened, and the risk of flooding increased in areas of Town, especially south of Waverly Street.

Water: After the population boom, the water supply system continued to expand but at a slower rate. Figure 1-6 compares the water mains installed from 1971 to 2003 (green) with those installed before 1971 (red and orange). About 46 miles of water mains were installed during this period. Of note during this period:

- Most pipes were constructed using ductile iron starting in the 1970s. This material is less brittle than cast iron, leading to fewer water main breaks in New England's freeze-thaw conditions.
- Very little maintenance was performed on the water system. The only repairs made were when a water main or service break occurred. Because of the inadequate maintenance, the number of breaks and service leaks rose to over 100 per year. In communities that maintain their water system, the number of breaks in a given year is usually much lower, about 40 for a similar sized community such as Brookline.

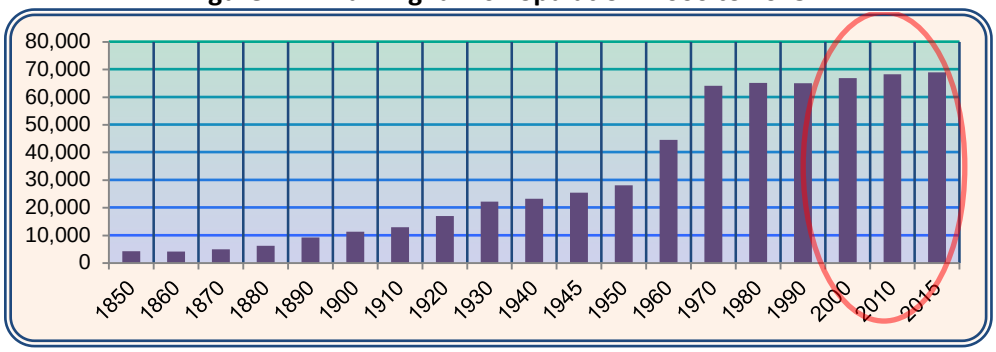
Wastewater: As with the water system, after the population boom the wastewater system continued to expand but at a slower rate. Figure 1-6 compares the sewer lines installed from 1971 to 2003 (green) with those installed before 1971 (red and orange). About 25 miles of sanitary sewer lines were installed during this period. During this time:

- Compared with the 21 pumping stations installed between 1946 and 1970 to support 135 miles of new pipe, 27 pumping stations were built between 1971 and 2003 to support just 25 miles of new sewer pipe. At its height, Framingham had 48 sewer pumping stations. By comparison, Boston is 10 times larger than Framingham in population but has only 8 sewer pumping stations.
- The pumping stations were small as they only supported a few homes, and were installed in areas that had already been partially built out, where the standard gravity system would not be feasible unless existing sewer pipes were reinstalled at a deeper level. Unfortunately the deeper sewers were not constructed.
- The proliferation of pumping stations has resulted in premature failure of the system throughout Town due to the production of corrosive gasses associated with force mains coming from the pumping stations.

1.4 Rebuilding Framingham: 2003 to Present

Since 2003, Framingham's population growth has slowed even further to about 3% over the last 13 years. There are signs that it may increase at a faster rate in the future, as shown in recent increases in the school-age population. The rezoning of certain districts for transit oriented development may also spur population growth. The current population is about 69,000.

Figure 1-7. Framingham's Population: 2000 to 2015



Public Works Management. Prior to 1996, a Board of Public Works managed the Department. The Board was composed of unpaid Town officials all of whom were part time overseers. The Chair of the Board signed all invoices and made all decisions. Starting in 1996, the Board hired a director, but the position had little authority. As a result, no director stayed in the position for long, and the Department had more than 5 directors in over 9 years. The goal of the department was to keep rates down, and spend as little as possible on operations and maintenance. Few, if any, improvements were made so as to keep tax and enterprise fund rates the lowest in the state. As a result, there was no documentation or mapping of the Town's assets, only anecdotal information regarding the systems. Staff had to guess at a pipe's location just to fix breaks and backups. From the Town's 1973 Annual Report, the Board of Public Works stated, "Unless we provide a methodical program of maintenance and repair for our facilities we may one day be faced with a need for total replacement of all facilities. The cost would be too burdensome for the taxpayers to afford."

In 2003 under new leadership, the Department began a transformation to a more professional operation in the following ways.

- The Department structure changed from hierarchical to programmatic. Each staff person was given responsibility for specific areas such as hydrants, along with authority and accountability for their equipment and their area of responsibility. Under this structure, instead of using a department truck to fix an unspecified problem not knowing what kind of tools might be needed, a staff person has the proper equipment in their truck for their specific asset.
- The Department began recruiting professional management staff. Each position was no longer a "job" but instead became a "profession".
- To understand the needs of the Town, the Department created an inventory of all infrastructure assets. This included major equipment, vehicles, water mains, hydrants, valves, water pumping stations, water tanks, sewer manholes, sewer mains, sewer pumping stations, drainage manholes, catch basins, drainage pipes, drainage outfalls, roadways, sidewalks and traffic signs. More recently, it has expanded to snow plowing routes, street acceptances, trees within the right of way, street lights, traffic lights, utility poles, easements, bridges and Town-owned underground power conduits.
- The Department took the fledgling Geographic Information System (GIS) and expanded it to catalogue all the Town's infrastructure assets. Today the GIS is used in daily operations to identify problems, document work orders and document subsequent repairs.
- The Department commissioned master plans for each of the major assets of roads, water, sewer and stormwater. These plans have identified problem areas and have made recommendations for repairs, rehabilitation, or replacement.
- The Department began meeting frequently with Town officials, residents and business owners to communicate the Town's infrastructure needs, findings of the master plans and progress towards the goal of improving the quality and life expectancy of the infrastructure.

Starting in 2006, the Department embarked on an accelerated Capital Improvement Program to improve the infrastructure. Since that time, the Department has replaced or improved systems in several challenging problem areas. Table 1-1 shows the improvements made to systems in the past 10 years.

Table 1-1. Infrastructure Improvements Since 2006

System	Current System Inventory	Improvements 2006 - 2015
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Wastewater	228 Miles of Gravity Main 6,900 Manholes 13 Miles of Force Main (originally 19) 42 Pumping Stations (originally 48)	Replaced 27 miles of pipe and associated manholes Eliminated 6 miles of force mains Eliminated 6 stations Replaced 9 stations

Table 1-2 provides a list of the projects completed that resulted in these improvements. While there is still much to be done, many of the most difficult repairs and replacements have been completed. The Department anticipates that there are still many major improvement projects required to return the Town's systems to a good condition, but most of these will consist of the relatively less complex pipe and associated structure replacement, pumping station upgrades and continued roadway resurfacing and rehabilitation.

Table 1-2. Public Works Infrastructure Projects Completed Since 2005

Project Name	Project Driver	Construction Period	
		Started	Completed
Franklin Street Water & Sewer	Age/Condition	2004	2005
Grove Street Water Improvements	Age/Condition	2005	2005
Carter Drive Water Improvements	Age/Condition	2005	2005
Edmands Road Water - Phase II	Age/Condition	2005	2005
Howard St, Hartford St, Bishop St, Loker St Water Improvements	Age/Condition	2005	2005
Howard Street Sewer Improvements	Age/Condition	2006	2006
Sucker Pond Drainage Improvements	Flooding	2007	2008
Edgell Road/Main Street/High Street Intersection	Age/Condition/Capacity	2006	2007
Concord Street / Waverly Street Intersection	Age/Condition	2007	2007
Cochituate Road Improvements	Age/Condition	2007	2007
School Street Bridge Deck Repair	Age/Condition	2007	2007
Edmands Road and Grove Street Repaving	Age/Condition	2007	2007
Fenwick Pump Station and Force Main Replacement	CWMP/ACO	2006	2008
Hemenway Pump Station Replacement	CWMP/ACO	2006	2008
Learned Pond Drainage Improvements	Condition/Water Quality	2008	2008
Sewell Street Drain Improvements	Age/Condition/Capacity	2008	2008
Saxonville Levee Certification	FEMA Requirements	2007	2008
Water Street Water Main Replacement	Water flow/quality	2007	2009
State Street Water, Sewer and Road Improvements	Age/Condition	2008	2010
Signalization: Beacon Street at Route 30, Potter at Elm Streets, High Street at Main Street, Pleasant Street at Edgell Road	Safety	2008	2008
Hardy Street Roadway and Bicycle Shoulder	Age/Condition	2009	2009

Project Name	Project Driver	Construction Period	
		Started	Completed
Pearl Harbor Water and Sewer Replacement	Age/Condition	2009	2009
Winthrop Street Sidewalks	Age/Condition	2009	2009
Main Street Bridge	Age/Condition/Public Interest	2000	2009
Fay/Cove/Waverly Water Improvements, including Fay Road, Weybosset Avenue, Daytona Avenue, Cove Avenue, Winthrop Terrace, Dow Street, Lake Avenue, Nipmuc Road and the portion of Waverly Street west of Winter Street	Water flow/quality	2007	2008
Water Street/Gregory Road Sewer Improvements (including portions of Hemenway Road, Simpson Drive and La Riviere Street)	CWMP/ACO	2008	2009
Herbert Street Bridge & Sewer Replacement	Age/Condition/Capacity	2008	2009
Elm/Potter Road Improvements	Age/Condition	2009	2009
Worcester Road Water & Sewer Improvements	MassDOT Road Rehabilitation	2009	2010
Goodnow Water Tank Rehabilitation	Age/Condition	2009	2009
New York Ave Pump Station	CWMP/capacity	2009	2010
Pearl Harbor Roadway Restoration	Age/Condition	2009	2009
Stalker Lane Sewer Replacement	Age/Condition	2009	2009
Water Street Water Main Replacement	Water flow/quality	2009	2010
Brackett Road Sewer Improvements	Age/Condition	2009	2009
Cove Ave Sewer Main Rehabilitation, including Lake Avenue, Dow Avenue, and Nipmuc Road	Age/Condition	2009	2009
Prospect Street Water/Sewer Improvements	Age/Condition/Roadway Project	2009	2010
State Street Utility Improvements	Age/Condition/Roadway Project	2009	2010
Michaud/Cypress/Ransom Pump Station Replacements	Age/Condition	2009	2010
McAdams Drainage Improvements	Age/Condition	2009	2009
William J. Heights Water Booster Station Replacement	Age/Condition/Water flow	2009	2010
Winthrop Street Water Services	Age/Condition	2010	2010
Carter Drive Drain Outfall Repair	Age/Condition	2010	2010
Eames Brook Pump Connection	Flooding	2010	2010
Frederick Street Sewer Replacement	Age/Condition	2010	2010
Kendall Street Sewer Replacement	Age/Condition	2010	2010
New York Avenue Utility Corridor improvements, including California Avenue	Age/Condition/Capacity	2010	2010
Farm Pond Sewer Interceptor Rehabilitation	CWMP/ACO	2010	2010
Maple Street Culvert Replacement	Age/Condition	2010	2010
Water Street West Local Sewer Improvements	Age/Condition/Re-alignment	2010	2010
South Concord Street Water/Sewer Improvements	Age/Condition	2010	2011
Rose Kennedy Lane Roadway Improvements	Age/Condition	2010	2010
Water Street Roadway Reconstruction	Age/Condition	2010	2011
Roadway Improvements (mill and overlay): Edmands Road, Grove Street, Maple Street, Millwood Street, Pamela Road, Spring Lane, Winch Street	Age/Condition	2011	2011
Pincushion Road Water Improvements	Age/Condition	2011	2011
Franklin Street Ext Water Improvements	Age/Condition	2011	2011
Brigham Road Water Improvements	Age/Condition	2011	2011
Franklin Street Traffic and Roadway Improvements	Age/Condition	2009	2011
Central Street Siphon & Sudbury River Interceptor Rehabilitation [Sewer], including Auburn Street, Auburn Street Extension, Beulah Street, and portions of Edgell Road and Central Street	CWMP/ACO	2010	2012
East Framingham Sewer Improvements	CWMP/ACO	2010	2012
"A" Street Waste Water Management Facility	Age/Condition/CWMP/ACO	2010	2012
Leland/Kendall/Beaver Street Roadway Improvements	Age/Condition	2011	2011
Freeman Area Sewer Replacement	Age/Condition	2011	2011
Torey Street Sewer Replacement	Age/Condition	2011	2011
Milton Street Sewer Replacement	Age/Condition	2011	2011
Davis Street Sewer Replacement	Age/Condition	2011	2011

Project Name	Project Driver	Construction Period	
		Started	Completed
Farm Pond Sewer Lining	Age/Condition	2011	2011
Broderick Drive Water Improvements	Age/Condition	2011	2011
Wood Avenue Water Improvements	Age/Condition	2011	2011
Fountain Street Bridge Replacement (MassDOT)	Age/Condition	2011	2011
Danforth Street Bridge Replacement (MassDOT)	Age/Condition	2011	2011
East Framingham Sewer Improvements Project, including portions of Concord Street, Arthur Street, A Street, Grant Street Extension, Gorman Road, Grant Street, Valentine Road and Anzio Road	CWMP/ACO	2010	2012
Sub Area U (Gates Street, Parker Road) Sewer Improvements	CWMP/ACO	2011	2011
Grant & Pond Street Area Sewer Improvements, including Grant Street, Pond Street, Elder Street, Eliot Street, Essex Street, Mansfield Street, Everit Avenue, Lawrence Street, Clark Street, Webster Street, Clinton Street, Wilson Street, Howe Street, C Street and portions of Arthur Street and Bishop Street	Age/Condition	2011	2011
South Concord Street Roadway Rehabilitation	Age/Condition	2011	2011
State Street Roadway Reconstruction	Age/Condition	2011	2012
Swift Road Water/Sewer/Drainage Construction	New Development	2010	2012
Pleasant Street Water Pump Station Rehabilitation	Age/Condition	2011	2012
Pleasant Street Water Transmission Main Improvements	Age/Condition/Capacity	2011	2012
Grove Street Water Pump Station Rehabilitation	Age/Condition	2011	2012
Coburn Street Area Water/Sewer Improvements including Mellen Street, Saucier Street, Bridges Street, Bridges Street Extension, Naples Street, Hilton Street, Clifford Street, Cypress Street and a portion of Winthrop Street	Age/Condition/	2011	2012
Roadway Improvements (mill and overlay): Pleasant Street, Winthrop Street, Wood Avenue, Arsenal Road, Anzio Road, Corregidor Road, Joyce Road, Overlook Drive West	Age/Condition	2012	2012
Prospect Street Roadway Reconstruction	Age/Condition	2012	2012
Vaillencourt/Lakeview Pump Station Elimination	Age/Condition/O&M cost/CWMP	2012	2012
Downtown Utility Improvements	Age/Condition/Roadway Project	2012	2012
Gilbert Street Water Main Rehabilitation	Age/Condition	2012	2012
Belvidere Avenue Sewer Replacement	Age/Condition	2012	2012
Waushakum Street Sewer Replacement	Age/Condition	2012	2012
Belvidere Avenue Sewer Replacement	Age/Condition	2012	2012
Belvidere Way Sewer Replacement	Age/Condition	2012	2012
Eaton/Chalis/Nob Hill Pump Station Replacement and Elimination	CWMP, Age/Condition	2012	2013
Grant & Pond Street Water Improvements	Age/Condition	2010	2013
Roadway Improvements (mill and overlay): A Street, Eaton Road, Eisenhower Road, Frederick Street, Guadalcanal Road, Kendall Street, Lincoln Street, Oak Street, Oran Road, Speen Street, Vernon Street	Age/Condition	2013	2013
Edgell Road Reconstruction (below Central Street)	Restoration following wastewater project	2013	2013
Arthur Street & Chouteau Avenue Roadway Restoration	Restoration following wastewater project	2013	2013
Concord Street and School Street Sewer Improvements	Age/Condition	2010	2013
Winter Street Bridge over Sudbury River (MassDOT)	Age/Condition	2013	2013
Wickford Road Bridge (MassDOT)	Age/Condition	2013	2014
Roadway Improvements (mill and overlay): Colonial Drive, Indian Head Road, John J Gallagher Drive, Murphy Circle, Potter Road, Salem End Road	Age/Condition	2014	2014
Concord Street and School Street Road Restoration	Restoration following water/wastewater project	2014	2014
Edmands Road Traffic Calming	Safety	2014	2014
Central Street Bridge Rehabilitation (near Edgell Road)	Age/Condition	2014	2014

Project Name	Project Driver	Construction Period	
		Started	Completed
Speen Street Force Main Realignment	Age/Condition	2014	2014
Bethany Road, Irving/Herbert Streets & Loring Drive Water & Sewer Improvements	Age/Condition	2014	2015
School Street Water Main Improvements Project	Age/Condition	2014	2015
Beebe Water Storage Tanks Replacement & Rehabilitation Project	Age/Condition	2014	2015
Winthrop and Waverly Streets Sewer Improvements Project	Age/Condition	2014	2015
Mellen Street & Winthrop Street Roadway Reconstruction Project	Restoration following water/wastewater project	2014	2015
Saxonville Intersection Improvements Project (Concord Street/A Street/School Street)	Condition/Capacity/Safety	2014	2015
Water Street Roadway & Safety Improvements	Age/Condition	2014	2015
Cochituate Rail Trail	Public Interest	2014	2015
Roadway Improvements (mill and overlay): Auburn Street, Auburn Street Extension, Belknap Road, Beulah Street, Gates Street, Newbury Street, Nicholas Road, Salem End Road, Temple Street, Whittier Road, Woodmere Road (sidewalks): Concord Street (bonded wearing course): Irving Street	Age/Condition	2015	2015
Various Crosswalks	Condition/Safety	2015	2015
Coburnville Roadway & Sidewalk Reconstruction Project	Restoration following water/wastewater project	2015	2015
Speen Street Sewer Interceptor	Age/Condition	2015	2015
Riverpath Drive Roadway Improvements	Capacity/New Development	2015	2015
Dyer Street Sewer and Water Main Replacement	Age/Condition	2015	2015
Kendall Lane Sewer Replacement	Age/Condition	2015	2015
Central Street Water Main Replacement (partial)	Age/Condition	2015	2015
Church Street Water Main Replacement project	Age/Condition	2015	2015

* Comprehensive Wastewater Master Plan/DEP Administrative Consent Order

The result is that the Department has earned increased credibility and trust throughout Town. The operating and capital budgets have increased to better meet the necessary infrastructure demands. Figure 1-8 shows the change between 1965 and 2015 in the funds expended to support operations and maintenance of the Town's infrastructure. The graph showing the capital appropriations highlights the period of time when little or no funds were appropriated for infrastructure maintenance. Figure 1-9 shows the history of Town's infrastructure from its early days to the present, with blue lines indicating new infrastructure since 2003.

Figure 1-8. DPW Capital and Operating Budgets

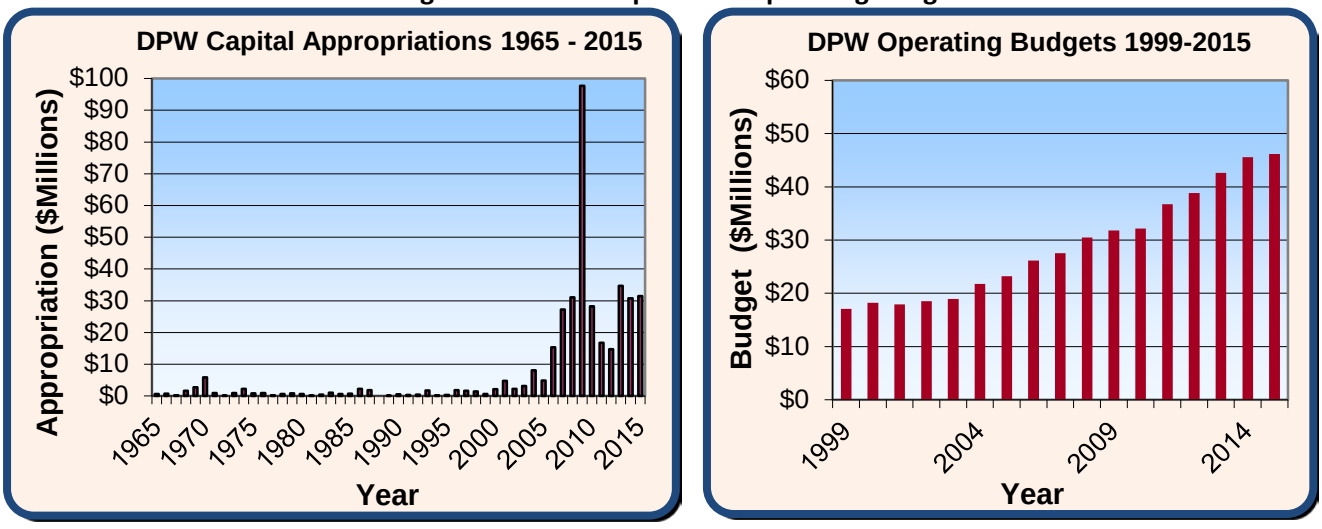
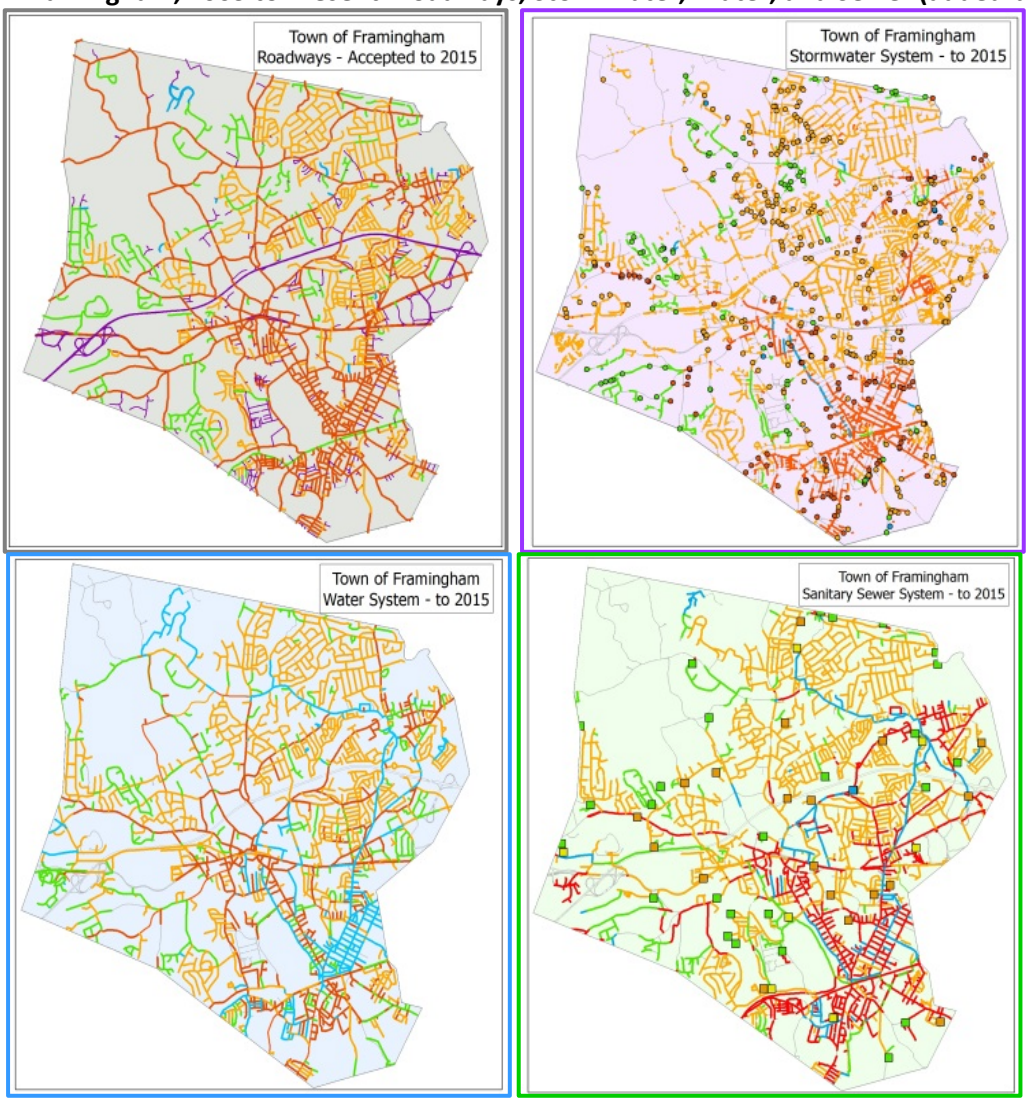
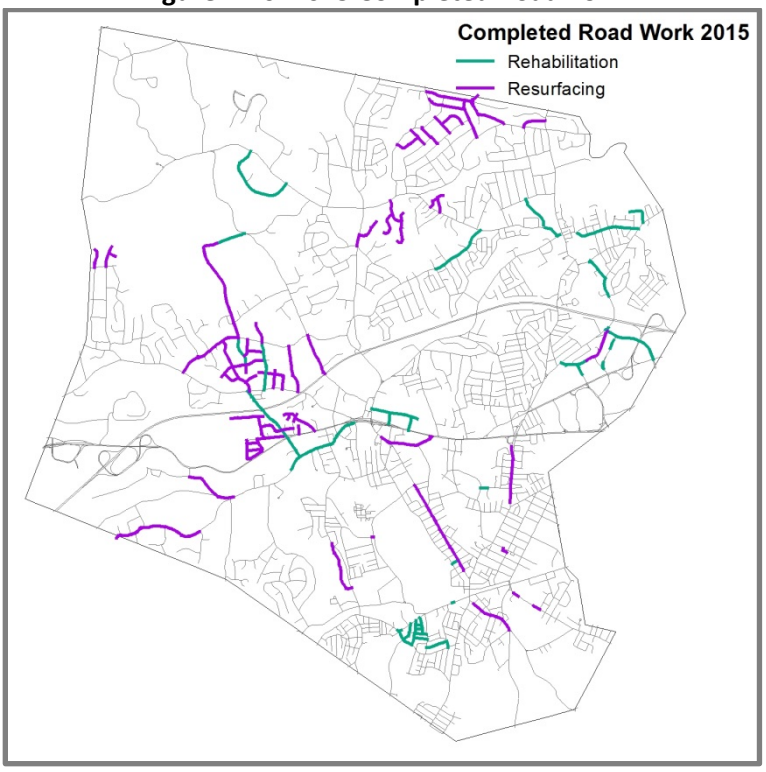


Figure 1-9. Framingham, 2003 to Present: Roadways, Stormwater, Water, and Sewer (added blue lines)



Roadway: In the last thirteen years, the Town has begun to invest significantly more in its roadways. For the last several years, the Town has appropriated several million dollars per year over and above the Chapter 90 funds for roadway reconstruction and resurfacing. Figure 1-10 shows the roadways that have been reconstructed or resurfaced just in 2015. Note that some of this work is intentionally temporary, such as on Union Avenue, to provide a temporary overlay after Eversource Gas replaced their gas mains in anticipation of the water, sewer, drainage and roadway improvements the Town is undertaking over the next two to three years.

Figure 1-10. 2015 Completed Roadwork



Transportation: With the renewed commitment to the Town's infrastructure, transportation services were added to the Department's purview. Transportation improvements include the following:

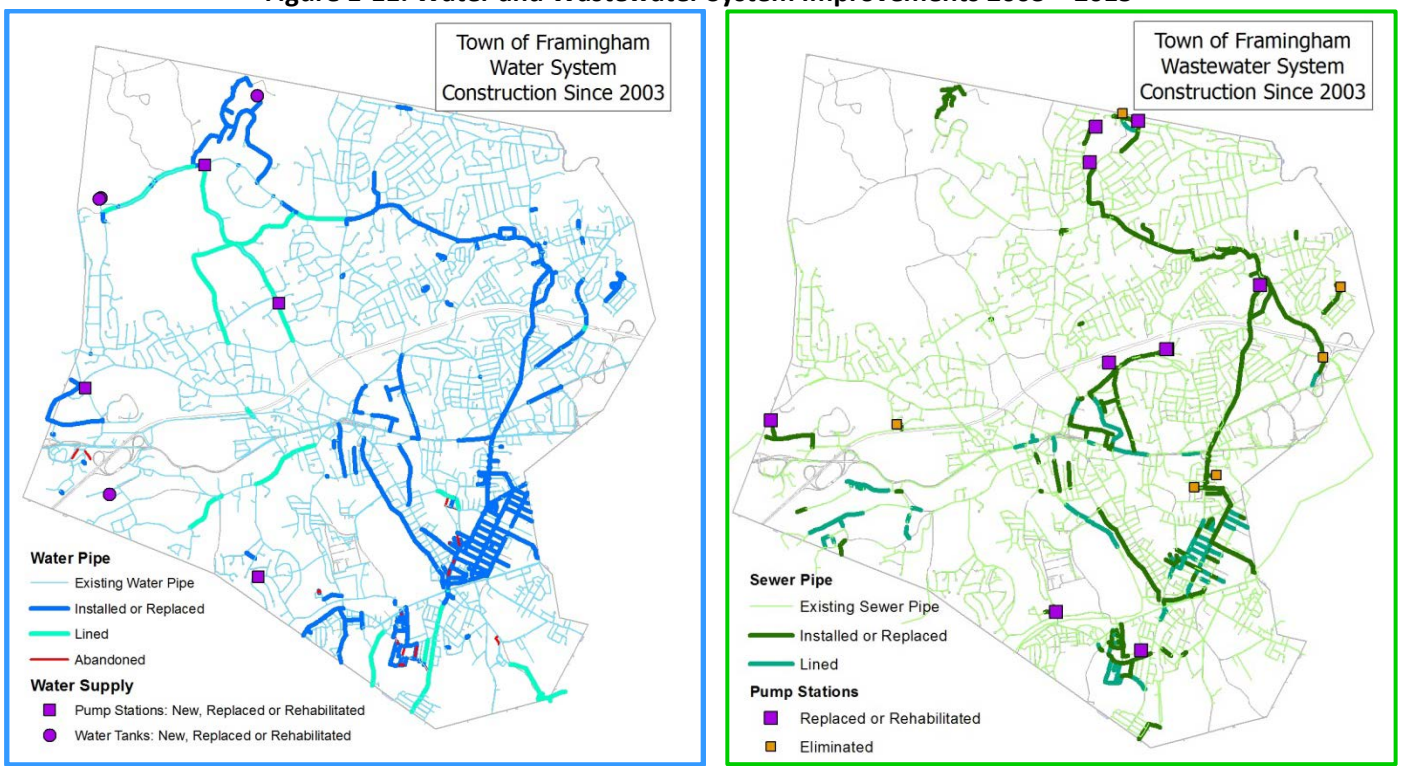
- Bridge rehabilitation/replacement. A 2013 Townwide bridge inspection and master plan included recommendations for repairs and replacement. The Town and/or MassDOT have repaired or replaced many of these bridges, including Danforth Street, the Danforth Street pedestrian bridge, Fountain Street, Franklin Street, Main Street, Central Street near Edgell Road, Wickford Road, Winter Street (by the reservoir) and Worcester Road at Main Street.
- Roadway improvements. Improvements have been made in the Downtown, Saxonville, several neighborhoods south of Waverly Street including the Coburnville area, the Old Town Center area on either side of lower Edgell Road, and Franklin Street. Improvements include not only roadway redesign and paving but also other transportation improvements such as street lighting, Americans with Disabilities Act (ADA) compliant sidewalk improvements, and bike paths in many areas. Other areas that have seen improvements include several areas south of Waverly Street.
- Intersection improvements. The Town and MassDOT began upgrading and signalizing intersections in 2010. Improvements have been made at the intersections of Beaver/Leland/Kendall, Elm/Potter, Franklin/Main, Franklin/Mount Wayte, School/Concord and School/A Streets.
- Pedestrian crossings. Eleven of the 750 pedestrian crossings have been signalized, most recently on Belknap Street, Edgell Road, Elm Street, the Cochituate Rail Trail, Waverly Street, Lincoln Street, Dudley Road and High Street.
- Retaining walls. From time to time, the Town repairs or replaces retaining walls that are within the right of way and are at risk of failure. Examples of these walls are along Water Street and High Street.
- Traffic calming. The Town recently began constructing traffic calming measures on a variety of roads. Such measures can be seen on Edmands Road, Winch Street and Millwood Street. These measures include signs, pavement markings and raised tables to encourage slower, safer traffic.
- Rail trail design and construction. The Town recently completed the Framingham portion of the Cochituate Rail Trail, extending from the Natick Town Line at Cochituate Road to Saxonville.

Stormwater: Beginning in 2003, the regulatory environment changed dramatically for stormwater. The U. S. Environmental Protection Agency (EPA) issued a new requirement for stormwater management under the National Pollutant Discharge Elimination System (NDPES) program. The Municipal Separate Storm Sewer (MS4) Program was initiated in 1999 for large cities (more than 100,000 population), and in 2003 Framingham became regulated under the extension of this program to smaller municipalities (less than 100,000 population). The program is further discussed in Section 2 of this report. Of note during this period:

- High Density Polyethylene (HDPE) pipe began to be used more frequently although reinforced concrete is still a popular material.
- The Town began education programs for understanding stormwater and how we can improve the quality of stormwater that flows into our rivers, brooks and wetlands. These have included presentations to schools, inserts to the Town bills, events such as Earth Day, river cleanups, community meetings and storm drain marking activities.
- The Department began testing brooks and rivers for pollutants in 2008 and has made a more concerted effort to improve water quality by minimizing sediments from street sanding, street sweeping, catch basin cleaning, pipe maintenance and outfall cleaning.

Figure 1-11 shows the water and wastewater improvements made since 2003. While much of the challenging work has been done, there is more challenging work today as only 10% of the water and wastewater pipes have been replaced or rehabilitated since their installation.

Figure 1-11. Water and Wastewater System Improvements 2003 – 2015



Water: Since 2003, the water supply system network has stabilized at about 276 miles of pipe. Figure 1-9 compares the water mains installed or replaced since 2003 (blue) with those prior to 2003 (red, orange and green). About 26 miles of water mains have been installed or replaced during this period. Of note during this time:

- In 2005 the Town embarked on a plan to remove lead pipes from not only the Town's water distribution system but from all residences in Town. As of March 2016, the Town completed implementation of this

plan. There are no lead pipes in the Town's water distribution system and there are no known lead pipes in any residential services.

- Most of the water mains that have been installed are replacements of older mains, such as Concord Street, Franklin Street, Grant and Bishop Streets, Water Street and neighborhoods in south Framingham.
- Several tanks and pumping stations have been extensively rehabilitated or replaced, including the two Beebe Tanks, Goodnow Tank, Pleasant Street Pump Station, Grove Street Pump Station and William J. Heights Booster Station. A new tank was installed in 2004 in the northwest quadrant, the Doeskin Tank.
- The Division implemented a maintenance program of exercising gate valves and hydrant flushing to ensure the system continues to operate in good condition.

Wastewater: Since 2003, the sanitary sewer system network has stabilized at about 241 miles of pipe, 228 of which are gravity lines and about 13 that are force mains (where sewage is pumped from a local low point instead of flowing solely by means of gravity). Figure 1-9 compares the sewer lines installed since 2003 (blue) with those up to 2003 (red, orange and green). About 17 miles of sanitary sewer lines were installed or replaced during this period, almost all of which are upgrades and replacement lines to aging sewers. Another 10 miles have been rehabilitated. Of note during this time:

- The Town reduced the number of sewer pumping stations from 48 to 42, by either eliminating the pumping station or by replacing two or three pumping stations with one pumping station, both of which solutions require reconfiguring the associated sewer lines. This change has significantly decreased the damage to the sewer system by reducing corrosive pollutants that are created when sewage needs to be pumped. The most recent example of combining two pumping stations into one is the A Street Pump Station, which replaced the Henry King Pump Station at Watson Place and the Speen Street Pump Station. A picture of the A Street Pump Station is provided in Section 4.4 of this report.
- In addition, the Town replaced or rehabilitated nine other sewer pumping stations, bringing them up to modern operational and safety standards. Pumps and other major equipment have been replaced within eight other sewer pumping stations.
- The Town installed monitoring equipment in all sewer pumping stations, using remote sensing equipment known as a Supervisory Control and Data Acquisition (SCADA) system. This system provides information to the staff to reduce the number of system overflows that can create backup situations for sewer system customers and also optimizes labor, allowing staff to focus on the most important work.
- Most importantly, the Town began to address the sewer configuration issues created by the haphazard construction of small systems that resulted in system overflows and rapid deterioration. Large scale reconfiguration projects the Town has completed or are currently in process include:
    - Water Street Sewer Improvements completed in 2009 increased the size of the sewer main to accommodate the development that had occurred after World War II but had been undersized since then, leading to significant sewer overflows;
    - East Framingham Sewer Improvement Project (EFSIP) completed in 2012 replacing four sewer stations with one station and eliminating over three miles of force mains;
    - Central Street Siphon / Sudbury River Interceptor (CSS/SRI) completed in 2012 eliminating two siphons under the Sudbury River and eliminating or rehabilitating two miles of pipe that led to the worst overflows along the Sudbury River;
    - Eaton Chalis Nob Hill Sewer Improvements completed in 2013 that replaced three pumping stations with two and replaced sewer lines on private property with lines in the roadway; and
    - The Worcester Road Pump Station Elimination Project currently in design will replace and relocate aging sewer lines between Walnut Street and Prindiville Avenue, reducing sewer overflows.

Sanitation: While the Town has provided health services for many years through curbside trash collection, the program was greatly expanded under the new management to provide comprehensive services to the Town.

More information on the Sanitation Division's current work can be found in Section 4 of this report. A short summary of services includes:

- Curbside trash collection. The Town picks up solid waste from residential properties on a weekly basis. In 2015 and 2016, the division began automated collection, saving money and decreasing the risk of injury to workers.
- Single stream recycling. A contracted service currently picks up recycling on a bi-weekly basis but plans to change to a weekly pickup schedule starting the summer of 2016, when the Town will take over this service, using the same automated collection as used for refuse. Educational efforts are ongoing to reduce refuse while increasing recycling.
- Recycling and Drop off center. A separate facility located on Mount Wayte Avenue provides a location for residents to recycle materials approved under state guidelines. In general, residents pay on an item-by-item basis to bring the bulkier items that won't fit into the home recycling bins to this facility.
- Yard waste disposal. The Town picks up appropriately bagged yard waste 11 weeks during the year from residential properties, including: (a) leaves and light trimmings, (b) brush (sticks, twigs, branches, shrubs) and (c) discarded Christmas trees.
- Major events throughout the year such as hazardous waste days, Shred Fest and electronics recycling continue to provide residents a way to utilize good practices for safe disposal.

2 Regulatory Environment

The regulatory environment provides the framework of policies and regulations under which the Town constructs and operates its infrastructure.

2.1 Roadway and Transportation

A *Policy on Geometric Design of Highway and Streets* by American Association of State Highway and Transportation Officials (AASHTO) defines the standards for design and maintenance of all the roadway components. The *MassDOT Project Development and Design Guide* supplements AASHTO standards on the State level. The *MassDOT Standard and Supplemental Specifications for Highway and Bridges* defines the construction standards for the infrastructure works in the Commonwealth of Massachusetts.

Roadway and transportation projects comply with the Manual on Uniform Traffic Control Devises (MUTCD). The MUTCD defines the standards to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel. It is a compilation of national standards for all traffic control devices, including road markings, highway signs and traffic signals. The MUTCD is published by the Federal Highway Administration (FHWA) under *23 Code of Federal Regulations (CFR), Part 655, Subpart F*.

The Americans with Disabilities Act (ADA) adopted enforceable standards for newly designed and constructed or altered local government facilities and public accommodations to be readily accessible to and usable by individuals with disabilities. ADA standards are incorporated in roadway, sidewalk, street crossing and other pedestrian route designs within the public right-of-way.

The Framingham Complete Streets Policy initiated by the state was adopted by the Board of Selectmen on January 6, 2015 solidifies the Town's commitment to create a safe transportation network for users of all ages and abilities. The adoption of this policy allows the Town of Framingham to be eligible for additional funding at the state level for infrastructure, planning and implementation of complete streets features, such as bicycle lanes, accessible curb ramps, sidewalks and crosswalks.

2.2 Stormwater

2.2.1 Stormwater

The Town's stormwater system is regulated by the EPA under the NPDES permitting program. The Town currently operates its storm sewer system under the NPDES Phase II MS4 General Permit (Permit No. MAR041116), effective May 1, 2003 and administratively extended until issuance of a new permit.

As required by the permit, the Town reports annually to the EPA and the Massachusetts Department of Environmental Protection (MassDEP) regarding the status of our implementation of permit requirements. This annual report provides a summary of stormwater management activities undertaken by the Town, including descriptions of the outfall screening, public education programs and other programs. Copies of the annual report are maintained at Framingham Public Works and are publicly available through the EPA's website. Additionally, Town regulations require that stormwater systems are designed and constructed to comply with the MassDEP's Stormwater Management Standards for new and re-development projects.

The Town anticipates that a new MS4 permit will be published within the next one to two years. This permit will require the Town to construct systems that meet requirements for water quality as well as retention in the form of infiltration closer to the source of the rainfall instead of conveying the water immediately to a wetland or river. The permit will also require more education and public awareness of stormwater issues and best management practices.

2.2.2 Levees

Unlike most area communities in Massachusetts, the Town has a working levee system, located along the left bank of the Sudbury River between the Central Street Dam and the pedestrian bridge north of Danforth Street. The levee was built by the U.S. Army Corps of Engineers (USACE) in the 1970s after major flooding from two back-to-back hurricanes in 1955. The system of earthen levees, concrete walls, pumping station and flood gates is known as the Saxonville Levee.

After the massive destruction caused by Hurricane Katrina in August 2005, the Federal Emergency Management Agency (FEMA) embarked on a program to ensure that existing levees throughout the country be in good repair. FEMA requires certified accreditation under National Flood Insurance Plan (NFIP) Regulations 44 CFR 65.10 "Mapping of Areas Protected by Levee Systems". Under these regulations, FEMA will only recognize levee systems that are certified to meet minimum design, operation and maintenance standards to provide protection during a 100-year flood. In 2009, the Town of Framingham completed a certification of the Saxonville Levee to meet the FEMA requirements.

The USACE Levee Safety Program assures that levee systems are reliable and do not present unacceptable risks to the public, property or the environment. Under this program, the Saxonville levee is inspected semiannually by Public Works, with annual inspections by the USACE. USACE rates the levee system based on these inspections and identifies deficiencies that require attention. The Town needs to maintain an "Acceptable" or "Minimally Acceptable" rating to continue to qualify for federal funding. The Town has successfully maintained these ratings since it was built, and has a solid working relationship with USACE.

2.2.3 Dams

Framingham's dams are regulated under the Massachusetts Dam Safety Statute, MGL Chapter 253 §§ 44-50, which identifies the responsibilities of dam owners to register, inspect, develop emergency action plans for high hazard potential dams and maintain dams in good operating condition. The Massachusetts Department of Conservation and Recreation's (DCR) Office of Dam Safety ensures compliance with acceptable practices pertaining to dam inspection, maintenance, operation and repair of dams. More information on the Town's dams is provided in Section 4.2 of this report.

2.3 Water

The quality of the Town's water is managed by the Massachusetts Water Resources Authority (MWRA) and regulated by MassDEP. The MWRA provides the Town with its water via an aqueduct known as the MetroWest Tunnel. The MWRA guarantees that the quality of the drinking water the Town receives meets the standards set by the federal requirements under the Safe Drinking Water Act.

The Town monitors MWRA's drinking water by sampling the water on a weekly basis at various locations. The Town analyzes a portion of the samples, and sends the rest to the MWRA laboratory in Marlborough for further analysis. MWRA water is well known for its outstanding taste and purity.

The EPA is currently revising regulations regarding lead pipes. As discussed in Section 1.4, the Town has already removed all known lead pipes from not only the Town's water lines, but also all residential services.

2.4 Wastewater

The Town's wastewater collection system is regulated by both the MWRA and MassDEP.

The Town manages the wastewater collection system and discharges the wastewater to the MWRA system located on Arthur Street. Under typical conditions the flow is conveyed in the MWRA Framingham Extension Sewer by gravity to downstream MWRA facilities and the Deer Island treatment plant in Boston. Under high flow conditions the MWRA-owned Arthur Street Pump Station allows for additional flows to be conveyed by the pumping station. The MWRA requires that its customers' wastewater meet certain standards. In the Town's 2002 wastewater permit, the MWRA required that Framingham meet standards to prevent damage to the pipes and not create problems downstream. Framingham entered into a settlement agreement with the MWRA in November 2002 to meet these standards. The agreement has been modified and extended since that time. Framingham continues to work to meet the settlement requirements, avoiding MWRA fines and protecting the Town's and MWRA's infrastructure.

In the event of an overflow or bypass of a sanitary sewer, MassDEP requires a notification if the wastewater is discharged from the Town's infrastructure to private property or the environment. In 2006, MassDEP contacted the Department to discuss instances of sanitary sewer system overflows from the wastewater system. At the same time, the Department was in the process of reviewing the history of the overflows and other problems with the wastewater system. The Department determined that significant work needed to be done to assess the wastewater system and proactively presented MassDEP with a long range capital improvement plan to repair and improve the system. MassDEP agreed with the plan, resulting in an Administrative Consent Order issued March 8, 2007. While the consent order was a mandate by the state agency, there were no fines levied to the Town because of the collaborative effort shown by the Department.

The Department then developed a Comprehensive Wastewater Master Plan, completed in 2008, containing 34 critical capital improvement projects to address the issues raised in the consent order. Table 2-1 shows the projects and their status as of 2016. As can be seen from the table, more than half the projects have been completed. While this work has resulted in major improvements to the operation of the wastewater collection system, the Department still has many projects to design and construct to make the necessary improvements to the system. In addition, repairs and replacement are needed for the pipes that are part of the wastewater system, especially the 21% of the Town's wastewater pipes and manholes that are more than 75 years old.

Table 2-1. Status of Critical Projects from the Comprehensive Wastewater Master Plan

Rank	Status	Project
1	Complete	East Framingham Sewer Improvements (install sewer interceptor from Concord St to Gorman Rd, Grant St, and Arthur St
2	Complete	Rehabilitate Saxonville Pump Station and reconfigure force main to discharge near Concord Street
3	Complete	Rehabilitate Speen Pump Station and reconfigure force main to discharge near Cochituate Road
4	Complete	Eliminate Arsenal Pump Station with gravity sewer to Concord Street
5	Complete	Eliminate Valentine Pump Station with gravity sewer to Concord Street
6	In Design	Eliminate Worcester Pump Station with gravity sewer; rebuild Kittredge Pump Station and force main; increase downstream gravity pipe
7	Complete	Install new gravity relief sewer along abandoned railroad to Hemenway Pump Station
9	Complete	Fenwick Pump Station Rehabilitation and Force Main Replacement
8	Complete	Replace sewer on Water/Simpson including inverted siphon
10	Complete	Cypress Pump Station and Force Main Replacement
11	Complete	Replace Lakeview Pump Station with Gravity to Intersection of Chouteau Ave. and LaClede Ave.
12	Complete	Replace Michaud Pump Station and Force Main
13	Complete	Replace Ransom Pump Station and Force Main with existing configuration
14	Complete	Consolidate Eaton and Chalis Pump Stations into common pump station and force main
15	Complete	Nob Hill Pump Station and force main replacement in existing configuration
16	In Design	Replace Little Farms Pump Station and force main with a larger station to handle flow from Larnis Pump Station
17	Complete	Replace sewer on Concord/School Streets including inverted siphon
18	In Design *	Rehabilitate Woodland Pump Station and Replace Force Main with a New Alignment
19	Planned for 2022	Eliminate Pleasant Pump Station and install gravity sewer in Vaillencourt Drive to 9/90 Interceptor

Rank	Status	Project
20	In Design	Flanagan Pump Station and Force Main Replacement
21	Planned for 2025	Eliminate Gates Pump Station; install gravity sewer to Salem End Pump Station; increase Salem End Pump Station, force main; increase downstream gravity sewer
22	Planned for 2019	Lavelle Pump Station and Force Main Replacement
23	Planned for 2021	Perry Henderson Pump Station and Force Main Replacement
24	In Design	McQuinn Pump Station Elimination w/ Synergy with SGP7-1
25	In Design	Replace Shawmut Pump Station and force main in a new location
26	In Design	Eastleigh Pump Station and Force Main Replacement
27	Planned for 2021	Victor Pump Station and Force Main Replacement
28	Planned for 2021	Shady Pump Station and Force Main Replacement
29	Complete	Replace Herbert St. siphon at Irving Street
30	Complete	Replace Beaver Dam siphon with double barrel siphon
31	Complete	Replace Central St. siphon with double barrel siphon (the siphon was eliminated)
32	Planned for 2028	Replace Purchase St. siphon with double barrel siphon
33	Complete	Replace Auburn St. siphon with double barrel siphon (the siphon was eliminated)
34	Planned for 2023	Replace Union Ave. siphon with double barrel siphon

* The Woodland Force Main is to be relocated and the pumping station equipment has already been upgraded.

2.5 Town Regulations and Standards

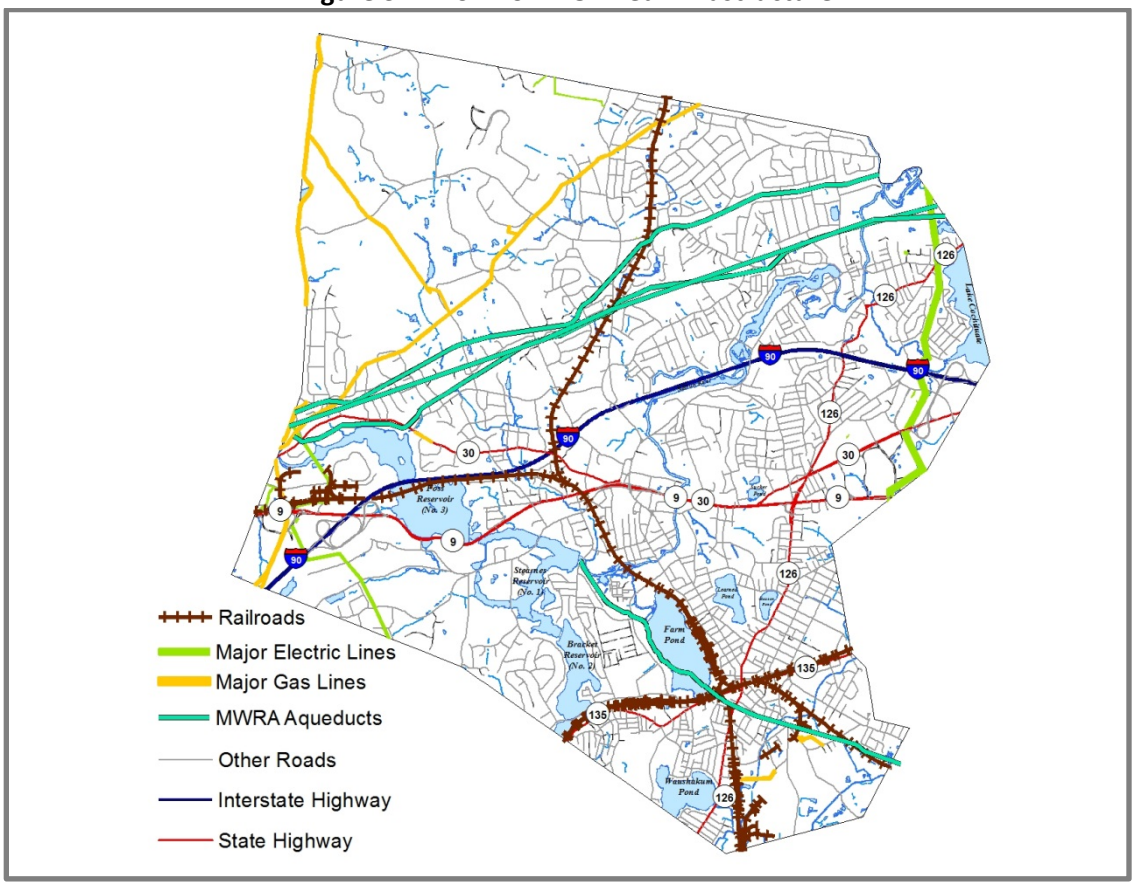
The Department maintains regulations for water and wastewater use and fees. In addition, the Department maintains the *Department of Public Works Construction Standards* to ensure that developers, consulting engineers, construction contractors and others design and construct roads, stormwater, water and sewer systems to the high level of quality the Town requires for efficient and trouble free operations of its infrastructure.

Whenever the Department designs improvements to the infrastructure, we need to meet all Town requirements, which often involve protection of wetlands and waterways through the Conservation Commission. Occasionally infrastructure projects are also reviewed by the Planning Board and other regulatory bodies and committees in the Town.

3 State and Private Infrastructure: Boon and Challenge

While Framingham's infrastructure is significant, there are many other utilities in the Town that each bring their own infrastructure into the Town. These include the railway system, MassDOT and federal highways, MWRA's aqueducts, Eversource gas and electric lines, Verizon telephone lines, and various cable companies' lines. These systems bring many boons to the Town in terms of transportation, energy, and communications. However, they also present challenges to our infrastructure in terms of physical conflicts and competing resources. Figure 3-1 shows most of these infrastructures in Town. Electric and gas lines within the roadways are not shown. Gas lines can be found within almost all roadways, just as electric lines although electric lines can be overhead wires or in subsurface conduits.

Figure 3-1. Non-Town Owned Infrastructure



3.1 Railways

CSX Transportation (CSX) and the Massachusetts Bay Transportation Authority (MBTA) own active and inactive rail lines in Framingham. Across the country, these are the oldest regulated transportation systems and have regulatory precedence over every other transportation system. The active lines run east-west paralleling Waverly Street, west-southeast from New York Avenue to Sherborn near Kendall Avenue, and south from Waverly Street to Sherborn east of Hollis Street. An inactive rail line is still owned by CSX that runs from Route 9 north and roughly parallel to Edgell Road. The railway owners allow the Town to own and operate roadway, stormwater, water, and wastewater systems on and under the rail lines. Installing these systems is very costly, and in addition the Town must obtain permits from the owners for any new infrastructure the Town needs to construct on their property.

3.2 Massachusetts Department of Transportation

The Massachusetts Department of Transportation (MassDOT) owns and operates the Massachusetts Turnpike (Route 90), Route 9 (Worcester Road), the southern portion of Route 126 (Hollis Street south of Nipmuc Road), and the western portion of Route 30 (Pleasant Street beyond the Massachusetts Turnpike). MassDOT is also responsible for the paved ways and the stormwater systems in these roadways. MassDOT allows the Town to own and operate water and wastewater systems in its roadways. MassDOT also owns and maintains several bridges in Town, including many on Town roadways. Similar to the railways, the Town must obtain permits from MassDOT for any new infrastructure the Town needs to construct in their right of way.

3.3 Massachusetts Water Resources Authority

The Massachusetts Water Resources Authority (MWRA) owns and operates 4 aqueducts and 3 reservoirs in the Town:

- The active MetroWest Tunnel that bisects the Town parallel to and north of Route 90;
- The backup Hultman Aqueduct that runs alongside of the MetroWest Tunnel;
- The backup Weston Aqueduct that runs parallel to and north of the MetroWest Tunnel;
- The backup Sudbury Aqueduct that runs from the dam at Stearns Reservoir near Winter Street to the southeast corner of Town, near Kendall Avenue;
- The Foss Reservoir, north of Tech Park and Route 90;
- The Brackett Reservoir, north of Fountain Street and east of Singletary Road; and
- The Stearns Reservoir that takes flows from both the Foss and Brackett Reservoirs, and outlets to the Sudbury River near Winter Street.

The MWRA permits the Town to own and operate water, wastewater systems and stormwater within the areas of MWRA control. Similar to the railways, the Town must obtain permits from the MWRA for any work and new infrastructure the Town needs to construct in the vicinity of MWRA infrastructure.

3.4 Department of Conservation and Recreation

The DCR owns and manages the Sudbury River, the main body of water flowing through the Town. All natural waters in the Town ultimately flow to the Sudbury River, although the waters in the Beaver Dam Brook watershed flows into Lake Cochituate in Natick before flowing into the Sudbury River.

DCR generally does not require permits to construct infrastructure within the Sudbury River, such as water and wastewater pipes. Instead, approval authority has been assigned by federal and state laws to the Town's Conservation Commission and to the USACE, both of which require strict permitting requirements be met prior to construction.

3.5 Eversource Gas and Tennessee Gas

Eversource Gas supplies the Town with energy through its natural gas transmissions. These are generally laid within the paved roadway, but there are a few cross-country lines. The Town permits Eversource to install, operate, and maintain its gas lines in the public way. Eversource needs to acquire easements from private property owners for gas lines to be run within their properties.

The Tennessee Gas Pipeline Company (now owned by Kinder Morgan) constructed large natural gas transmission lines through the Town in the 1940s, mainly in the northwestern quadrant. Most of these active transmission lines run through private property, but some are within Town controlled roadways.

3.6 Eversource Electric

Eversource Electric supplies the Town with energy through its electric transmission lines that are transmitted either through overhead wires or underground conduits throughout the Town. The transmission lines are usually underground conduits laid in duct banks within the roadway right of way, but there are a few cross-country lines. The Town permits Eversource to install, operate and maintain its electric lines in the public way through a Grant of Location process. As with gas mains, Eversource needs to acquire easements from private property owners for electric lines to be run within their properties.

3.7 Verizon and other cable/telephone providers

Similar to Eversource Electric, Verizon and various communications and cable providers (for example RCN and Comcast) supply the Town with communications lines that can be either through overhead cables or underground conduits throughout Town. These are generally constructed within the roadway right of way. The Town permits these companies to install, operate, and maintain their systems in the public way via Grants of Location. Property owners permit communications lines to be run within their private property through easements granted to the companies. In addition, while Verizon and Eversource jointly own almost all the utility poles in Town, Verizon sets and removes poles when needed.

4 Current Operations

Framingham Public Works currently manages four major areas of infrastructure within the Town: roadways, stormwater, water distribution and wastewater collection. In addition, the Department provides traffic design and management services to further support the roadway infrastructure. In addition, the Department provides a major direct service to the Town: sanitation and solid waste management.

4.1 Roadways

The roadways provide users with safe travel ways on 900 Town roads covering 250 miles, all day, every day including during weather events.

4.1.1 What is included in this service?

4.1.1.1 Roadway Resurfacing:

Placing rubber chip seal topcoat

a. Installation. Roadways are resurfaced that are either in poor condition or require restoration after the Capital Program's utility projects have finished installing water, sewer and drain pipes. Three levels of resurfacing are:

1. *Simplest*: Surface treatment by preventive maintenance. There are two types of treatment:
   - Rubber Chip Seal installation includes placing a leveler shim course, raising all water, sewer, drainage, electric and gas castings to the finish grade, adjusting driveway aprons, and applying a rubber chip seal topcoat. We then restore traffic markings such as roadway center lines, stop lines, and fog lines.
   - Bonded Wearing Course installation includes sealing the road surface with a polymer modified asphalt emulsion sprayed onto the road surface followed immediately by an overlay of hot mix asphalt. We then raise all castings to the new grade and restore traffic markings.
2. *More comprehensive*: Structural improvements using mill and overlay. With this treatment, the existing roadway is milled (ground) down and old upper layers of asphalt removed. The castings are then adjusted. The roadway is then restored using up to two courses of hot mix asphalt. The road must be re-graded to ensure proper drainage, as the original grading is lost when the existing surface is removed during the milling process.

Paving a milled roadway

The work involved in this treatment goes beyond the pavement. Drains are replaced, if needed, before paving. The curbs are re-laid or replaced if they are damaged or provide inadequate reveal (height above the roadway) for drainage. Sidewalks are rebuilt if they are in poor condition. Pedestrian improvements such as ADA (Americans with Disability Act) ramps and crosswalks may be installed. Street signs are replaced as needed. Finally, the landscaped areas are loamed and seeded.

3. *Most comprehensive*: Full reclamation and reconstruction. With this process, the existing roadway is not only reconstructed, but the underlying material, called the sub-base, is also removed and replaced with better grade material.


Installing new granite curbs

The roadway is then reconstructed similar to the mill and overlay treatment with one major difference. Because we need to do a comprehensive restoration of the road, we take advantage of the opportunity to redesign the road for safer travel and meet new standards and guidelines for streets. Options include modifying the alignments for traffic flow, adding turning lanes, improving the grading for drainage, widening the pavement, improving intersections, installing bike lanes and pedestrian crossings and redesigning parking areas. More information about these improvements can be found in the Section 5.5.

4. Additional treatments to extend the service life of a road include sealing the road using crack sealing. Another life-extending treatment is a Stress Absorbing Membrane Interlayer (SAMI) treatment. This resilient, waterproof fiber membrane is installed on the existing pavement before the top layer of asphalt to reduce cracking.

b. Maintenance: We constantly monitor roadway conditions and repair problems as they arise. This includes repairing sinkholes and potholes, patching pavement that has been damaged, mowing and dressing roadway edges.
c. Replacement: Road surfaces need to be replaced every 8 – 20 years, depending on the surface treatment and wearing caused by day-to-day traffic load. Roadways are also replaced or resurfaced after large infrastructure projects where significant trenching has impacted the roadway surface.

4.1.1.2 Sidewalks, Markings, Signage and Street Trees:

a. Installation: As part of comprehensive roadway resurfacing, we install sidewalks, pavement markings such as roadway center lines, traffic control signs, other signs and street trees.
b. Maintenance: We maintain over 170 miles of sidewalk, 5,000 traffic and street signs, 728 crosswalks and thousands of street trees (trees that are in the right of way).
c. Replacement: Concrete sidewalks can last 20 to 50 years if there are no encroachments such as tree roots that are close to the surface or installation of water and sewer services that disturb these important walkways. Trees may last 20 to 200 years, depending on the type of tree and site conditions.


Thermoplastic crosswalk is durable and aesthetically pleasing

4.1.1.3 Winter Snow Plowing:

a. Maintenance: Framingham is renowned for our safe streets during and after winter storms. Not only do we plow all Town streets but also over 90 miles of the total 170 miles of sidewalk, 187 cul de sacs

and 36 parking lots so that children within walking distance can get safely to school and emergency vehicles can reach those in trouble. In the record breaking winter of 2015, we removed over 500,000 cubic feet of snow from our roadways. In this case, the roadway surface may have an impact on the plowing operations as raised structures may damage the plows.

4.1.2 What do we do to maintain our roadway system?

Different road treatments carry different costs. Simple resurfacing averages $250,000 per mile, milling and overlay is about $750,000 per mile and a full reclamation can range from $1,000,000 to $2,000,000 per mile. In the last 5 years, we have spent an average of $400,000 per mile for all roadway resurfacing.

4.2 Stormwater

When it rains, it drains. The Town's stormwater system provides over 200 miles of drainage pipes and open channels, that:

- Protects property and property value;
- Keeps our streams, rivers and lakes clean;
- Prevents flooding of personal and public property;
- Provides safe travel conditions during rain; and
- Protects healthy recreational opportunities and aesthetically pleasing neighborhoods.

4.2.1 What is included in this service?

4.2.1.1 Storm drains:

a. Installation: There are over 8,200 catch basins (sometimes referred to as drainage grates) in Framingham. We install storm drains with catch basins on public roads and parking lots to safeguard them from flooding and capture pollutants like trash before entering our water resources.
b. Maintenance: We inspect and clean every catch basin annually. Around 400 tons of material is removed from catch basins (e.g. sand, leaves and trash) and disposed off-site annually. Over 450 priority catch basins and manholes are repaired, adjusted or refurbished annually.


A sinkhole at a catch basin creates a safety hazard

c. Replacement: Storm drains and catch basins are replaced as needed, every 50 years on average, as the material degrades and wears out due to impacts from constant traffic. As catch basins are replaced, improvements are added such as deep sumps to contain debris and hoods to hold floatable material and enhance pollutant removal.

4.2.1.2 Subsurface Drainage Pipes:

a. Installation: The Town has over 200 miles of subsurface storm drainage pipes and culverts; in a wide range of size, material, and shape. These pipes divert and convey stormwater runoff away from public and private land and facilities to local wetlands, streams, lakes and the Sudbury River.

Installing a catch basin Installing drain pipe

- Maintenance: We inspect and clean around 50,000 feet of drainage pipe annually.

Drain pipe clogged with roots and soil

View of clear drain line

- Replacement: On average, 700 feet of high priority pipes and associated headwalls are repaired and replaced each year. Pipes and culverts are replaced as needed, every 50 years on average, as the pipe material corrodes or wears out.

Laying out new drain pipe

View of partially collapsed drain pipe

4.2.1.3 Open Conveyance Channels (drainage swales or ditches):

Drainage swale at Western Avenue

a. Installation: The Town has over ten miles of open conveyance channels. These manmade channels divert and convey stormwater runoff away from public and private assets into local wetlands, streams, lakes and the Sudbury River. For example, the Town is responsible for the operations and maintenance of the Mill Street Diversion Channel which was constructed to support the Constance Fiske Dam project.
b. Maintenance: We inspect and maintain over 1,500 feet of open conveyance annually, some with assistance from Middlesex County Mosquito Control program. This agency has specific expertise, equipment and regulatory authority to perform critical emergency work.

We clear overgrowth along the channels to maintain slope

Removing debris from Sucker Brook

Drainage vault installed at Learned Pond

integrity and proper flow. We also inspect the Mill Street Diversion Channel annually with DCR.

c. Replacement: When maintained properly, open conveyance channels do not need to be replaced. Unfortunately, due to historic alteration to streams and severe degradation due to urbanization, many channels in Framingham need to be restored to their original hydrology to mitigate flooding and improve water quality.

4.2.1.4 Water Quality Best Management Practices (BMPs):


Smart Sponge® Filters

a. Installation: Water quality BMPs include activities or structures that improve the water quality of stormwater discharged from the Town's stormwater system to surrounding wetlands and rivers. The Town has installed nine water quality structural BMPS including: seven vortex separators, one subsurface infiltration basin, and one SmartSponge® filter vault. Our stormwater master plans recommend several BMPS be built to address water quality degradation. Our goal is to install one to two water quality BMPs annually.
b. Maintenance: We inspect the BMPs annually and maintain them per manufacturer recommendations. Filters need to be replaced every 5-7 years.
c. Replacement: Water quality BMPs are required to comply with the Massachusetts DEP Stormwater Management Standards and are incorporated into new capital projects. Approximately $250,000 needs to be invested annually to replace old infrastructure with water quality BMPs.

4.2.1.5 Flood Control Systems

a. Installation: There are nine dams in Town, eight that are owned and operated by MWRA, the DCR or are privately owned. The Town owns one dam (Landham Pond Dam). Planning and design for removal of this dam and ecological restoration were approved at the 2015 Town Meeting to help mitigate flooding in the Hemenway area.

The Town of Framingham operates and maintains the flood protection works known as the Saxonville Flood Damage Reduction Project (Saxonville Levee) constructed by the USACE in 1979. The levee comprises 2,500 feet of earthen dikes, 1,350 feet of concrete walls, a pumping station at Watson Place with associated drainage, a steel vehicular gate on Concord Street, and a sluice gate at the Central Street Dam. The Central Street Dam (also known as the Saxonville Dam) itself is privately owned and operated.

The Town also operates and maintains the flood protection works known as the Sherwin Terrace Gate and Pump that helps protect the areas around Farm Pond and Eames Brook from flooding during heavy storms.


Closing vehicular gate on Concord Street

b. Maintenance: We inspect the Saxonville levee twice a year, once in conjunction with the USACE. We inspect and monitor the system before, during and after every major storm event.

Like the Saxonville levee, we exercise the Sherwin Terrace flood gate and pump annually and inspect and monitor the system before, during and after every major storm event.

The Town also maintains and operates five automated stream gauges to monitor major storms and assist with mitigation.


Levee wall from Central Street Bridge

c. Replacement: Based on the age and condition of the Saxonville levee, the Town will need to invest an estimated average of $15,000 annually in addition to regular O&M to repair deficiencies and replace components identified by USACE during their annual inspection in order to maintain an "Acceptable" rating and remain eligible for federal funding under USACE's Levee Safety and Rehabilitation Programs.

The Sherwin Terrace pump support structure was repaired in 2009.

4.2.1.6 NPDES regulatory compliance:


Street sweeping keeps debris out of catch basins

a. Installation: The Town of Framingham is authorized by the EPA to discharge stormwater under the NPDES Phase II MS4 General Permit (Permit No. MAR041116), effective May 1, 2003. Under the permit, the Town is required to implement a Stormwater Management Plan to report progress to the EPA annually.
b. Maintenance: The permit requires that the Town identifies, implements and tracks the progress for the following six minimum control measures:
   - Public Education and Outreach
   - Public Involvement and Participation
   - Illicit Discharge Detection and Elimination
   - Construction Site Stormwater Runoff Control
   - Post-Construction Stormwater Management in New Development and Redevelopment
   - Pollution Prevention/Good Housekeeping for Municipal Operation


Sampling drain outfalls for water quality

To meet these requirements:
   - We conduct street sweeping of every public roadway annually and more frequently in urbanized areas.
   - We complete engineering reviews and on-site inspections of over 250 new and re-development projects annually for compliance with construction and post-construction stormwater requirements.
   - We inspect approximately 120 stormwater outfalls annually for water quality and maintenance needs.

c. Replacement: The EPA anticipates issuing a new Phase II NPDES permit in 2016 with increased requirements. The Town anticipates that the new requirements will double our annual cost for compliance to this permit.

4.2.2 What do we do to maintain the Town's stormwater management system?

The Town currently spends about $1,100,000 per year to maintain the drainage system. Approximately $850,000 is spent on operations and maintenance, much of which is used to sweep the streets and clean the catch basins

and pipes. Another $250,000 is used for capital improvements such as replacing pipes or structures. Additionally, we invest about $15,000 a year in maintaining the Saxonville levee.

4.3 Water Supply and Distribution

The Town's water distribution system provides an uninterrupted supply of water every hour of every day to satisfy the water requirements of our residential, commercial, and industrial users and for fire-fighting. The Town uses an average of 6.5 million gallons of water each day.

4.3.1 What is included in this service?

4.3.1.1 Water Mains and Valves:


Installing water mains and valves

a. Installation: Our potable water is supplied by the MWRA via four connections to Framingham's water distribution system. This network consists of approximately 276 miles of water mains varying in size from 6 inches to 24 inches. The water mains are generally located within the public street limits with individual service connections from the main up to each property line. Gate valves are provided in strategic locations throughout the distribution system for maintenance and to isolate sections of the surrounding systems if work or repairs on one section must be performed. Once the water line is installed in a trench typically 5 feet below ground surface to prevent freezing, we ensure the line is pressure tested, disinfected, and then backfill the trench and repave the roadway.

b. Maintenance: The Town ensures the quality of the water by testing it routinely. The Town utilizes the MWRA laboratory to analyze regular water samples for chlorine residual and total coliform. We regularly samples and tests the water distribution system at 18 locations throughout Town on a weekly basis following a plan approved by MassDEP. We repair water main breaks when they happen, usually on older pipes.


Installing water mains and valves

In the 15-month period of January 2013 to March 2014, the Water and Sewer Division repaired 155 water main and service breaks, about normal for the Town's water system, where about 25% of the pipes are over 75 years old. The Town has specialized valve trucks equipped to record GPS location and to measure the amount of torque and number of turns required to operate a valve. Crews are sent out 2-3 days per week during the year to exercise each of the 6,740 valves to ensure they can operate when needed for system maintenance or during an emergency. Each year, the Town performs a leak detection survey to identify, locate, and repair system leaks.

c. Replacement: Water mains and valves need to be replaced every 75 years on average as the pipe and valve materials corrode or wear out. Replacement intervals may be more frequent and vary depending upon site specific soil conditions, pipe material, and installation methods.

4.3.1.2 Hydrants:

b. Installation: There are 2,360 hydrants in Framingham. We install hydrants in strategic locations for fire prevention and to flush mains to help maintain water quality within the distribution system. Hydrants are installed with separate isolation valves and service connections to the main.
c. Maintenance: A crew inspects hydrants generally 5 days per week, on a year round basis.
d. Replacement: Hydrants are replaced as needed and concurrently with water main capital improvements projects. The replaced hydrants are often kept so that portions can be used for spare parts.


Exercising fire hydrants keeps them ready for emergency use

4.3.1.3 Pumping Stations and Storage Tanks:

a. Installation: There are 4 water supply pumping stations and 3 booster stations in Framingham with capacities ranging from 150 to over 4,000 gallons/minute. There are 6 water storage tanks with a combined volume of 9 million gallons. The Town has installed the stations and storage tanks in strategic locations to provide the volume and pressure to service customers in the surrounding properties.
b. Maintenance: Pumping stations and storage tanks are inspected, maintained and monitored on a daily basis.
c. Replacement: As pumping stations age their capacity and efficiency are reduced. Pumps are either replaced or rehabilitated every 20 years and pumping station buildings are rehabilitated or replaced every 50 years. Storage tanks are rehabilitated every 25 years or replaced every 40 to 50 years.


Constructing new Beebe Water Tank

4.3.2 What do we do to maintain our water system?

On average, the industry standard for pipe replacement is every 75 years. Water tanks need to be rehabilitated every 25 years and replaced every 50 years. Pumping stations need to be rehabilitated or replaced every 50 years, but pumps need to be replaced every 20 years. We currently spend over $5,000,000 per year to maintain the system, and over $14,000,000 per year for capital improvements.

4.4 Wastewater Collection

The Town provides for the uninterrupted collection of wastewater every hour of every day to satisfy the requirements of our residential, commercial, institutional and industrial users. We discharge an average of 7.5 million gallons of wastewater each day to the MWRA collection point at the Arthur Street MWRA pumping station. This volume is higher than the amount of water we obtain from the MWRA system largely because of inflow and infiltration. Inflow and infiltration, often abbreviated as I/I, is extraneous water coming into sewers via defects such as cracks, holes and joints in the pipes and manholes. In general, inflow refers to rainwater and infiltration refers to groundwater intrusion, but the industry usually discusses both together.


Constructing new sewer in Concord Street

4.4.1 What is included in this service?

Repairing a sewer main break on Speen Street

4.4.1.1 Wastewater Collection Mains and Manholes:

a. Installation: Our wastewater is collected by a network of pipes and manholes located throughout the Town and conveyed to the MWRA's collection system via the Framingham Extension Sewer located on Arthur Street. Our wastewater is ultimately treated at the MWRA's Deer Island Treatment Plant in Boston. The Town's wastewater collection system consists of about 241 miles of sewer mains varying in size from 6 inches to 42 inches. The wastewater collection mains are generally located within the public street limits with individual service connections from the main to each property line. Approximately 6,560 manholes are provided in locations throughout the system for access for inspection, maintenance and repairs. Manholes are at all locations where collection pipes intersect and along straight runs at least every 300 feet.


Constructing new sewer main

b. Maintenance: We ensure the efficient operation and maintenance of our wastewater collection system by performing daily inspection, preventative maintenance and repairs. We routinely inspect the mains using closed circuit television (CCTV) technology. We utilize specialized trucks known as vactor trucks that use suction to flush and remove any settled materials from the manholes and sewers.
c. Replacement: Sewer mains and manholes need to be rehabilitated or replaced every 50 to 75 years on average as the construction materials corrode or wear out over time.

4.4.1.2 Pumping Stations:

a. Installation: There are 42 active wastewater pumping stations in Framingham with capacities varying from 100 to over 6,000 gallons/minute. The stations are located in strategic locations throughout the Town to pump and convey wastewater to sections of the system that flow by gravity.
b. Maintenance: Pumping stations are inspected, maintained and monitored on a daily basis.
c. Replacement: The pumps and other internal workings of pumping stations are either replaced or rehabilitated every 20 years. The pumping station buildings are replaced every 50 years.


"A" Street Sewer Pumping Station blends with the community surroundings

4.4.2 What do we do to maintain our wastewater system?

Pumping station life can be extended by replacing internal workings such as pumps and controls. The life of a sewer pipe can be extended by periodic jetting and cleaning, and sometimes by lining the inside of the pipe using a polymerized flexible lining inserted into the pipe and then hardened using a special process. In addition, the Town provides minor treatment of some sewer pipes by introducing a biocide at some of the larger pumping stations, to lower the concentration of corrosive chemicals generated within the force mains. We currently spend over $4,500,000 per year to maintain the system, and about $13,000,000 per year for capital improvements.

4.5 Traffic

We work to provide the Town with safe and efficient vehicular and pedestrian traffic for our residents and those who travel within Framingham.

4.5.1 What is included in this service?

4.5.1.1 Traffic Signals:


Traffic lights on poles are stable, help traffic detection and are aesthetically pleasing

a. Installation: There are over 40 traffic signals at major intersections throughout Town. The Town installs "smart" signals that adjust timing based on traffic and include emergency pre-emption signaling to allow passage for emergency responders. Newly installed ornamental signals improve neighborhood aesthetics.
b. Maintenance: The Town maintains the signals on a daily basis. Signals are evaluated approximately every other year to asses if timing needs to be adjusted.
c. Replacement: Traffic signals need to be replaced periodically due to normal wear and tear and sometimes more frequently based on neighborhood development or increased roadway use.

4.5.1.2 Bridges

a. Installation: The Town owns 33 bridges, with the remainder owned by MassDOT. MassDOT is responsible for bridge safety for the bridges in the Town and provides regular bridge inspections for the larger bridges.
b. Maintenance: The Town contracts with bridge contractors to repair and replace all structural and safety components of the Town's bridges, including sidewalks, joints, guard rails, abutments, and other bridge components.
c. Replacement: The Town rehabilitates or replaces at least one major bridge per year. Most bridge projects are sponsored and funded by State's Transportation Improvement Program (TIP) and managed by MassDOT. To be eligible for TIP funding, the Town must typically fund and prepare the design. Some bridge projects, such as the Maple Street culvert over Baiting Brook and the Herbert Street Bridge over Beaver Dam Brook, are funded and managed entirely under the Town's Capital Improvement Program.


Repairing Winter Street Bridge at the MWRA Reservoir

4.5.1.3 Pedestrian access improvements

a. Installation: The Town has adopted the "Complete Streets" approach for pedestrian access improvements, which includes bicycle lanes, accessible curb ramps, sidewalks and crosswalks. To increase and enhance pedestrian access, there are over 170 miles of sidewalk and 750 pedestrian roadway crossings, of which more than ten are signaled. The Town has added ornamental


New signalized pedestrian crosswalk improves safety

street lighting for improved safety and aesthetics at eight sites.

b. Maintenance: Painted crosswalks need to be refreshed annually. Signalized crossings and street lights are inspected on a regular basis and replaced as needed. Signage is usually replaced every 5 to 10 years due to deterioration and reduced visibility.

c. Replacement: Sidewalks need to be replaced as the concrete or asphalt degrades or when it is damaged. When sidewalks are replaced, they are redesigned to comply with ADA requirements, such as adding ramps and warning surfaces. Crosswalks located within capital or roadway improvement project limits are upgraded to stamped thermal crosswalks that are more durable, visible and aesthetically pleasing.

Replacing old painted crosswalk with more durable thermoplastic materials

4.5.1.4 Traffic Calming

a. Installation: Once reviewed by the multi-departmental Traffic and Roadway Safety Committee (TRSC) and then approved by the Board of Selectmen, the Town plans, designs and constructs traffic calming measures and other safety improvements to public roadways to improve the safety and livability of Framingham's streets and neighborhoods. Approximately one large and two small projects are identified to be implemented each year. The Edmands Road traffic calming project included raised tables, roadway markings, and signage. Small projects typically involve features such as signage or parking changes.

b. Maintenance: The Town conducts monthly TRSC public meetings with members of the Board of Selectmen, Public Works, Police and Fire Departments. The Town conducts one to two traffic studies per year based on the feedback from the TRSC.

c. Replacement: Traffic calming projects need to be revaluated for effectiveness as major traffic impacts occur (i.e. new development).

Traffic calming measures on Edmands Road

4.5.2 What do we do to maintain our traffic services?

Traffic patterns and signaling need to be revaluated for effectiveness every 5 to 10 years or as major traffic impacts occur (i.e. new development). Pedestrian access needs to be improved throughout Town to support the Complete Streets policy and community and economic development initiatives. Bridges need to be rehabilitated or replaced every 50 to 75 years and typically require multi-million dollar investments, much of which is often funded by the state. We currently spend about $500,000 per year to maintain the system and make capital improvements.

4.6 Solid Waste Management

The Solid Waste Management Division manages and oversees the Town's solid waste and recycling programs.

4.6.1 What is included in this service?

4.6.1.1 Curbside Collection

The Town provides several curbside collection programs. Solid waste is collected on a weekly basis using an automated pickup system that provides cost effective, efficient pickup that is consistent with current technology and industry standards, as well as protecting the health of our staff. Recycling materials are collected on a bi-weekly basis using the same automated pickup system. Division personnel collect refuse and recycling from more than 18,000 dwelling units weekly, averaging more than 3,300 stops and 142,000 pounds of trash per day collected.


Automated refuse packer saves time and worker health

The Town offers special curbside collection for eleven weeks a year for leaf litter, brush and discarded Christmas trees. We also offer special curbside collection of bulky items for a fee if scheduled in advance by the resident.

4.6.1.2 Recycling Drop Off Center

Residents can deliver bulky items for a fee to the Town's Recycling Drop Off Center on Mount Wayte Avenue.

The Town offers annual household waste disposal events, where residents can deliver items to the Recycling Drop Off Center or to the Western Avenue facility, depending on the event.

4.6.1.3 Yard Waste Facility

Residents can deliver properly bagged yard waste and brush to the Yard Waste Facility on Dudley Road Friday through Sunday on a seasonable basis.

4.6.2 What do we do to maintain our sanitation services?

Sanitation services require a fleet of eight special refuse packers that include a self-loading, single operator, automated refuse collection system. Along with other support vehicles, these vehicles need to be maintained and replaced periodically. However, as most of the large vehicles were purchased recently for the new collection system, the Town will not need the major infusion of capital for its vehicles in the near term.

The Recycling and Drop Off Center facilities will require upgrades in the next several years. The staff and equipment are well positioned to continue to provide the Town with efficient and exceptional solid waste and sanitation services. We currently spend about $4,000,000 per year for collection, disposal, and vehicle replacement.

4.7 Other utilities

Framingham is in the process of installing several forms of communications systems. The systems use a variety of signal paths, including fiber optic cable, radio wave receivers and wired instruments. The communications systems include:

- Fire operations, including alarm systems;
- Remote monitoring of the operations at the Town's water tanks, water pumping stations, and wastewater pumping stations using Supervisory Control and Data Acquisition (SCADA) systems;
- Traffic cameras at key intersections throughout the Town; and

- Pavement sensors that monitor roadway temperature to assist the Snow and Ice Program with significant data points around both rural and urban areas of Town.

Framingham is also designing improvements to our streets to better facilitate a variety of transportation modes such as pedestrian, automotive, handicapped and bicycle traffic, as well as connecting these modes to the bus routes, railway system and state highways. Improvements include safer crosswalks, sidewalks and ramps that are fully ADA compliant, street lighting and bicycle lanes.

The Town also incorporates energy efficiencies when operating and maintaining infrastructure. This includes using hybrid vehicles, electric vehicles, LED lighting, pumps and other components of the infrastructure.

5 Future Plans

5.1 Growth Areas

As of this writing, the Town has identified three areas for potential growth. These areas include the newly rezoned Central Business District in the downtown area, the Tech Park and 9/90 areas off the Massachusetts Turnpike (MassPike) Interchange 12, and the Golden Triangle area off the MassPike Interchange 13. The basic infrastructure of roadways, drainage, water, and wastewater exist in all the three known growth areas. Therefore likely improvements in these three areas would consist mostly of expansion of the existing infrastructure.

5.2 Regulatory changes

5.2.1 NPDES Permit

Compliance with the EPA's proposed NPDES permit requirements, which could become effective in 2016, could double the annual cost for the Town's stormwater management. The following are new major requirements of the proposed permit:

- All Town properties will be included in the permit, including but not limited to schools, parks, conservation areas and Town facilities whereas previously permit compliance focused on the roadway drainage system;
- Increased stormwater management is required for new and re-development that is more stringent than the current MassDEP Stormwater Standards and Town bylaws;
- Additional operations and capital investments will be required for drainage areas to impaired waterbodies that include: Cochituate Brook, Farm Pond, Framingham Reservoir #2, Lake Cochituate and Waushakum Pond;
- Additional storm sewer system inspections and maintenance will be required annually;
- Increased inspection and sampling for water quality and illicit discharges will be required; and
- Significant increases for administration and reporting for permit compliance will require increased coordination amongst Town Departments

5.2.2 MassDEP Wastewater Regulations

MassDEP has promulgated changes to its wastewater regulations governing inflow and infiltration and pumping stations (310 CMR 12.04 "Maintenance of Treatment Works and Sewer Systems") that must be implemented by December 2017. The Town is already in compliance with these new regulations due to the Town's progress with the MassDEP consent order discussed in Section 2.4. We not only have plans to reduce inflow and infiltration, we have also implemented many of the projects in those plans. The updated Comprehensive Wastewater Master Plan being developed this year will bring the Town up to date with documentation of its efforts to improve the wastewater system.

5.3 Technology improvements

Several technology improvements will help the Town monitor our infrastructure:

- The Town is in the process of upgrading its wireless network throughout the Town so remote access to the Geographic Information System (GIS) will allow us to locate problem areas, enter work orders and document actions taken. There are still areas of poor reception that are targeted for improved access.

- Monitoring devices can be installed in the roadways to record physical properties such as temperature that can then be used to help predict the freeze thaw impacts to the roadway.
- Remote monitoring of the pumping stations and water tanks is planned to be enhanced with new SCADA tools.

5.4 Current infrastructure maintenance

The budgets allocated to maintain Framingham's infrastructure at current operating levels are provided in Table 5-1. Costs reflect direct staff, equipment, and materials, but not administrative support services. In addition, these costs do not include other services provided by Public Works, including snow plowing, fleet, municipal engineering or other administration services.

Table 5-1. Current Annual Costs to Maintain Framingham's Infrastructure

Infrastructure Component	Operating Costs	Capital Costs	MWRA Fees	Total Annual Cost
Roadway	$3,000,000	$5,500,000	N/A	$8,500,000
Stormwater	$800,000	$300,000	N/A	$1,100,000
Water	$5,200,000	$14,200,000	$8,200,000	$27,600,000
Wastewater	$4,600,000	$12,900,000	$12,100,000	$29,600,000
Traffic	$200,000	$300,000	N/A	$500,000
Sanitation	$3,700,000	$400,000	N/A	$4,100,000

Notes:
Costs are rounded to the nearest $100,000.
Fees are funds paid to MWRA for water and wastewater supply and services.
Operating Costs and Fees were calculated using FY2016 budgets.
Capital Costs were calculated using an average of FY2015 and FY2016 budgets, except for Sanitation where Capital Costs were calculated using an average of several years' worth of budgets to mitigate the recent expenditures for the automated trash/recycling pickup program.
Figures do not include Chapter 90 funds received from the state.

5.5 Future Cost of Infrastructure

5.5.1 Cost for Replacement of Framingham's Infrastructure

Figure 5-1 provides a graphic representation of the cost of installing various types of infrastructure in Framingham. This includes installing new systems as well as upgrading older systems. Note that the cost is not strictly cumulative. If water and sewer systems are replaced, the entire roadway might be resurfaced rather than simply replacing the roadway surface that was disturbed when the system was installed. In this case, the cost of the resurfacing would be included in the water and/or sewer cost, and there would be no accompanying roadway cost.

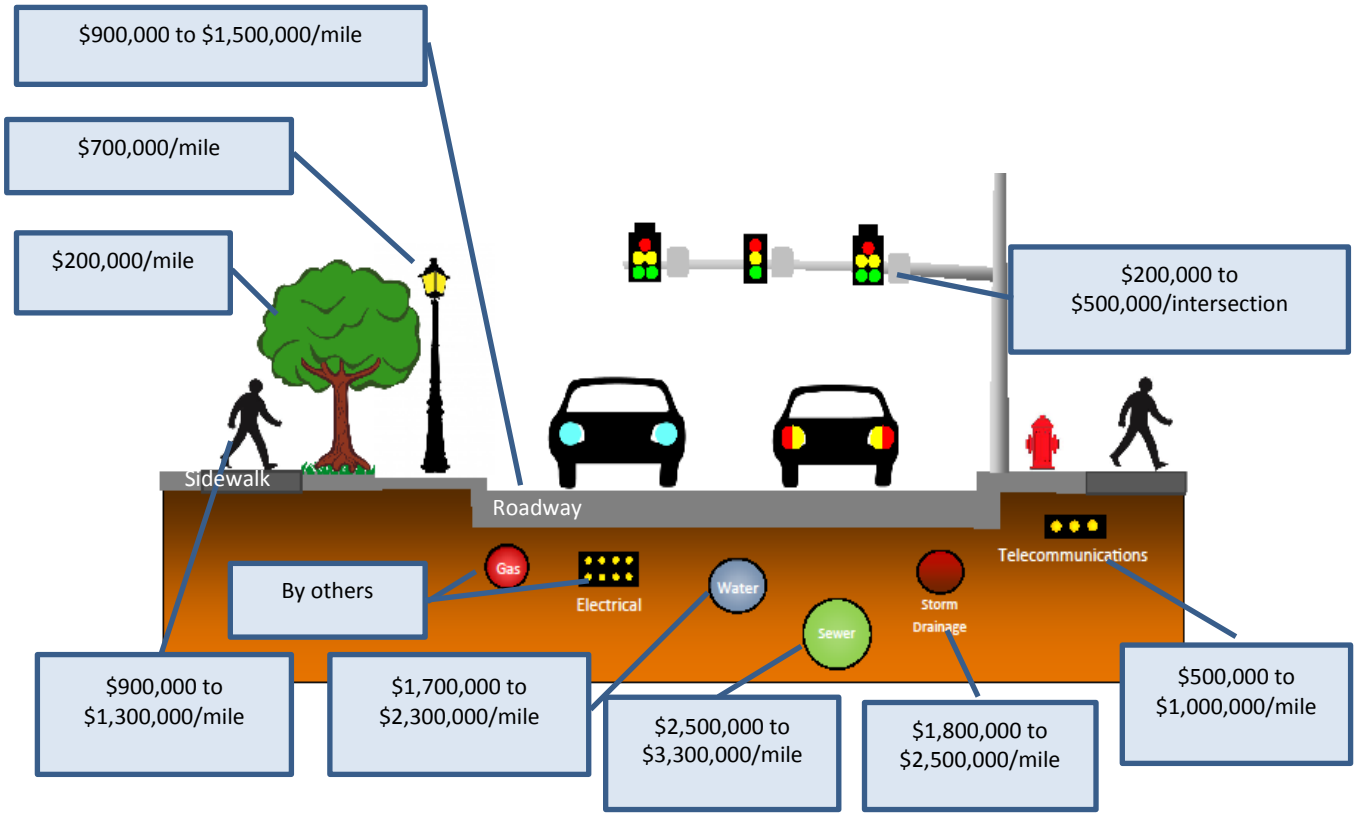
These costs were obtained by reviewing nine of the Town's larger capital projects from the last three years and averaging unit costs for each component of the infrastructure. Some costs were allocated over all the infrastructure projects, including engineering costs, soil and hazardous waste disposal costs and traffic management costs such as police details (personnel used to manage traffic) and electronic message boards.

This is just one of the reasons that Figure 5-1 shows a range of costs for most of the infrastructure components. Other factors contributing to the range of costs have to do with the difficulty of the work, for example whether

the system is being installed in ledge or a sandy area, where there was previous contamination or in an area where the groundwater is high.

Still other factors have to do with traffic volume in the work area. If the roadway is highly traveled, more police details are required. The work may require detours or construction of an alternate route. Some roads are so busy that the work must be done at night. Each of these traffic management components increases the cost of the project.

Figure 5-1. Framingham Infrastructure Costs



5.5.2 Funding Sources

The Town takes advantage of opportunities for grants and other advantageous funding wherever possible. In the past 10 years, the Town has obtained over $14,000,000 in state and private grants, mostly through the MassWorks Infrastructure Program and the Massachusetts Life Sciences Center. MWRA distributes grants to the participating communities, and Framingham has received over $10,000,000 in such grants. The Town also received over $5,000,000 in grants under the federal American Recovery and Reinvestment Act for wastewater improvement projects. The Town used over $1,500,000 in mitigation funds to improve all components of the infrastructure. We also receive between $1,500,000 and $2,000,000 every year from the state's Chapter 90 funds for roadway improvements. Finally, the state has provided low interest loans that the Town participates in when market interest rates are high enough to make participation worthwhile. However, compared with these external funds totaling over $30,000,000, the Town has spent over $300,000,000 of its own money to fund infrastructure improvements in the last 10 years.

5.5.3 Annualized Cost for Replacement of Framingham's Infrastructure

Once the cost of replacement is determined, the lifecycle provides a basis for determining an annual cost of work that needs to be performed to maintain our infrastructure. In general, roadways that have been significantly improved are built to last approximately 20 to 25 years before rehabilitation is required. Water, wastewater, and stormwater (drainage) pipes last an average of 50 to 75 years before replacement is required.

Table 5-2 provides an estimate of the capital costs required to maintain and upgrade Framingham's infrastructure assuming repair and replacement follows standard life cycles for the components. Note that the costs are not divided into General Fund vs. Enterprise Fund accounts. Water and wastewater projects often result in damage to a roadway or drainage system which otherwise do not require replacement or rehabilitation. In these cases, the enterprise funds may contribute a portion or all of the costs for repair or replacement of the roadway or stormwater infrastructure. Therefore, the costs are provided in aggregate to give an estimate of the funds required on an annual basis to maintain Framingham's infrastructure in good working condition.

Table 5-2. Estimate of Annual Capital Costs to Maintain and Upgrade Framingham's Infrastructure

Infrastructure Component	Inventory	Average Lifecycle (years)	Average Unit Cost ($)	Annual Capital Cost ($)
Roadway				
Roadway (miles)	250	25	$1,100,000	$11,000,000
Sidewalks (miles) *	170	50	$1,100,000	$3,740,000
Green Space (miles)	150	40	$200,000	$750,000
Street Lighting (miles)	5	50	$660,000	$70,000
Vehicles/ Equipment	82	15	$130,000	$710,000
Stormwater				
Pipes, Structures (miles)	200	75	$2,300,000	$6,130,000
Outfalls	350	75	$10,000	$50,000
Levee & Dam	2	100	$4,000,000	$80,000
NPDES MS4 Program	N/A	N/A	$100,000	$100,000
Vehicles	6	15	$180,000	$70,000
Sanitation				
Vehicles	19	10	$190,000	$360,000
Traffic				
Signalized Intersections	40	25	$300,000	$480,000
Bridges**	33	75	$300,000	$130,000
Electrical Conduit (miles) ***	11	50	$726,000	$170,000
Other (e.g., Traffic Calming, Signalized Crosswalks)	N/A	N/A	$250,000	$250,000
Water				
Pipes, Valves (miles)	276	75	$2,000,000	$7,360,000
Pump & Booster Stations	7	50	$4,000,000	$560,000
Water Tanks	6	50	$5,000,000	$600,000
Vehicles/ Equipment	39	10	$90,000	$350,000
Wastewater				
Pipes, Structures (miles)	240	75	$2,900,000	$9,280,000

Infrastructure Component	Inventory	Average Lifecycle (years)	Average Unit Cost ($)	Annual Capital Cost ($)
Pumping Stations	42	50	$500,000	$420,000
Vehicles/ Equipment	36	10	$90,000	$320,000
Total Annual Infrastructure Costs				**$42,980,000**

Notes
* Sidewalks: Assumes that a mile of sidewalk only includes one side of the road.
** Bridges: For smaller bridges, the Town's cost is typically for design and deck repair, with the average cost being $400,000 for the work. For larger bridges, the Town typically prepares a 25%-level design (also known as a conceptual design) for $200,000 or more and then the project is placed on the state's Transportation Improvement Program list for state funding and construction.
*** Electrical conduit: At this time approximately half the electrical conduit lines for Framingham's communications needs (fire, water and wastewater systems) is in place. When complete, the system will include about 11 miles of conduit.

5.6 Summary

The Town is in the middle of a period where not only many of our water, wastewater, and stormwater pipes are over 70 years old and are at or near the end of their life expectancy but also many other pipes installed 45 to 70 years ago are deteriorating at a faster rate than expected. To replace these systems before there is catastrophic failure, the Town needs to upgrade, rehabilitate or replace its infrastructure at a faster rate than shown in Table 5-2. An updated master plan for the wastewater systems is currently in process, and similar plans are in the process of being proposed for water, stormwater, and traffic master plans. These will provide more information on what is needed to upgrade and maintain the Town's infrastructure over the long term.

The Town's situation is not uncommon. Indeed, it is similar to that experienced by most municipalities in Massachusetts, and there is a growing political support for providing cities and towns in the United States with improved infrastructure. Framingham has recognized this need and provided significant funds for improvements in the last 10 years. It is critical that this support be continued to improve the Town's infrastructure and return it to an acceptable level of service, operating in an efficient manner and in good condition. Once this level is achieved, ongoing maintenance will be required to keep the systems in the good condition the Town has been working hard to achieve.